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This Rapid Acquisition of Manufactured Parts (RAMP) Product Data Translation System (RPTS) Printed Wiring Assembly (PWA) Product Data Definition Document (PDDD) establishes the digital standards and formats used in Technical Data Package (TDP) information for a PWA manufacturing facility.



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TABLE OF CONTENTS

| SECTION | TITLE | PAGE |
|---|---|---|
| TABLE OF CONTENTS | | i |
| LIST OF FIGURES | | iv |
| LIST OF TABLES | | v |
| LIST OF ACRONYMS | | vi |
| RECORD OF CHANGES | | ix |
| 1.0 | SCOPE | 1 |
| 1.1 | SCOPE | 1 |
| 1.2 | Purpose | 1 |
| 1.3 | Introduction | 1 |
| 1.4 | Application | 1 |
| 1.5 | Terms and Abbreviations | 2 |
| 2.0 | APPLICABLE DOCUMENTS | 3 |
| 3.0 | RAMP PWA PRODUCT DATA DEFINITION | 5 |
| 3.1 | Schematic Electrical Functional Product Data | 5 |
| 3.1.1 | EDIF Cells | 5 |
| 3.1.2 | EDIF Views | 5 |
| 3.1.2.1 | View Interface | 7 |
| 3.1.2.2 | View Contents | 7 |
| 3.1.2.3 | ViewMap | 8 |
| 3.1.3 | EDIF Level | 8 |
| 3.1.4 | EDIF Technology | 8 |
| 3.1.5 | EDIF Libraries | 8 |
| 3.1.6 | EDIF Object Relationships | 8 |
| 3.1.6.1 | Name Relationships | 8 |
| 3.1.6.2 | Containment Relationships | 9 |
| 3.1.7 | EDIF FigureGroups | 9 |
| 3.1.8 | EDIF RAMP Test Entities | 9 |
| 3.1.8.1 | Component Part Type (PTYPE) | 9 |
| 3.1.8.2 | Reference Designator (RDES) | 10 |
| 3.1.8.3 | Component Value (CHTYP_VAL) | 11 |
| 3.1.8.4 | Component Positive Tolerance (CHTYP_PTL) | 11 |
| 3.1.8.5 | Component Negative Tolerance (CHTYP_NTL) | 12 |
| 3.1.8.6 | Component Generic Part Name (GPN) | 12 |
| 3.1.8.7 | Component Logic Type (CHTYP_LT) | 12 |
| 3.1.8.8 | Component Applicable Specification (AP_SPEC) | 13 |

TABLE OF CONTENTS (CONT'D)

| SECTION | TITLE | PAGE |
|---|---|---|
| | 3.1.8.9 Component Part Number (PN) | 13 |
| | 3.1.8.10 Component Item Number (ITEM) | 14 |
| | 3.1.8.11 Commercial And Government Entity Code (CAGE) | 14 |
| | 3.1.8.12 Component Classification (CLASS) | 14 |
| | 3.1.8.13 Component SubClassification | 15 |
| | 3.1.8.14 Component Package (PKG) | 19 |
| | 3.1.8.15 Component Maximum Working Voltage (MAX_WRK_VOLT) | 20 |
| | 3.1.8.16 Component Power (COMP_PWR) | 20 |
| | 3.1.8.17 Component Lead Solderability (SOLDERABILITY) | 20 |
| | 3.1.8.18 Component Lead Material (LEAD_MAT) | 20 |
| | 3.1.8.19 Component Lead Plating (LEAD_PLT) | 21 |
| | 3.1.8.20 Component Quantity (Qnty) | 21 |
| | 3.1.8.21 Component Revision Level (REV) | 21 |
| | 3.1.8.22 Quantity Unit (QUNIT) | 21 |
| | 3.1.9 EDIF File | 22 |
| 3.2 | Printed Wiring Board | 22 |
| | 3.2.1 IPC Entity Usage | 22 |
| | 3.2.1.1 General Records | 22 |
| | 3.2.1.2 Line Records | 22 |
| | 3.2.1.3 Subroutine Definition Records | 26 |
| | 3.2.1.4 Point Records | 27 |
| | 3.2.1.5 Subroutine Call Records | 29 |
| | 3.2.1.6 Annotation Records | 30 |
| | 3.2.2 IPC Parameter Records | 30 |
| | 3.2.2.1 Job Parameter | 31 |
| | 3.2.2.2 DIM Parameter | 31 |
| | 3.2.2.3 Units Parameter | 31 |
| | 3.2.2.4 Layer Parameter | 31 |
| | 3.2.2.5 Image Parameter | 32 |
| | 3.2.2.6 FAB Parameter | 32 |
| | 3.2.3 IPC Feature/Location Records | 32 |
| | 3.2.4 IPC-D-350 NAMING CONVENTION PWA 2D LAYOUT CAPTURE | 32 |
| 3.3 | Components | 34 |
| | 3.3.1 Supported IGES Entity | 34 |
| | 3.3.2 As-Received 3D Component Data | 36 |
| | 3.3.2.1 Form Factor Set | 36 |
| | 3.3.2.2 Other Parts List Information | 36 |
| | 3.3.2.3 Component Dimensional Attributes | 37 |
| | 3.3.2.4 As-Received Components Translated Into IGES | 38 |

TABLE OF CONTENTS (CONT'D)


| SECTION | TITLE | PAGE |
|---|---|---|
| | 3.3.2.5 As-Received Component IGES File Naming | 38 |
| | 3.3.3 As-Assembled 3D Component | 39 |
| | 3.3.3.1 Reference Designator | 39 |
| | 3.3.3.2 Pin Numbers | 39 |
| | 3.3.3.3 Component Bodies | 40 |
| | 3.3.3.4 Component Leads | 40 |
| | 3.3.3.5 Orientation Vector | 40 |
| | 3.3.3.6 Centroid | 40 |
| 3.4 | 3D Assembly | 41 |
| | 3.4.1 Maximum Assembly Envelope | 41 |
| | 3.4.2 Conformal Coat Mask | 41 |
| | 3.4.3 Ink | 41 |
| | 3.4.4 Glue | 43 |
| | 3.4.5 Special Assembly | 43 |
| | 3.4.6 Assembly Data List | 43 |
| | 3.4.7 IGES Layering Convention | 44 |
| | 3.4.8 Special Instructions | 46 |
| | 3.4.9 3D Assembly Solid Model | 46 |
| | 3.4.10 3D Assembly Surface Model | 46 |
| | 3.4.11 3D Assembly Wireframe Model | 47 |
| 3.5 | TDP Raster | 47 |
| | 3.5.1 Raster File Naming | 47 |
| | 3.5.2 1840 Header Definition | 48 |
| 3.6 | CALS File Naming Convention | 50 |
| | 3.6.1 ISF File Naming | 50 |
| | 3.6.2 DPD Release Level | 52 |
| | 3.6.3 Declaration File | 52 |
| | 3.6.4 File Header | 52 |
| | 3.6.5 File Name Summary | 55 |
| | 3.6.6 Physical Media for File Transfer | 56 |
| APPENDIX I | PDD Formal Syntax | I-1 Thru I-12 |
| APPENDIX II | Component Orientation Vector | II-1 Thru II-4 |
| APPENDIX III | Component Class Sub PTYP Pkg Reference | III-1 Thru III-8 |
| APPENDIX IV | Data List | IV-1 Thru IV-2 |
| APPENDIX V | TRR Component Attributes | V-1 Thru V-10 |
| APPENDIX VI | TRR IGES Layering Convention for TRR | VI-1 Thru VI-2 |
| APPENDIX VII | TRR RPTS to RAMP PWA Factory Mapping | VII-1 Thru VII-3 |

# LIST OF FIGURES


| FIGURE | TITLE | PAGE |
|---|---|---|
| 3-1 | EDIF Schematic and Component Data | 6 |
| 3-2 | IPC PWB Data | 23 |
| 3-3 | IPC-D-350 Example for an 8-Layer PWB | 33 |
| 3-4 | IGES Assembly Data | 42 |
| 3-5 | CCITT G4 Raster Data | 49 |
| 3-6 | MIL-STD-1840 File Naming | 51 |
| 20-1 | Component Orientation Vector | II-2 |

# LIST OF TABLES


| TABLE | TITLE | PAGE |
|---|---|---|
| Table 1-1 | Product Data and Related Standards | 2 |
| Table 3-1 | Component Classification | 15 |
| Table 3-2 | Component SubClassification | 16 |
| Table 3-3 | Component Package | 19 |
| Table 3-4 | RAMP IGES Entities | 34 |
| Table 3-5 | IGES Layering Convention | 44 |
| Table 3-6 | MIL-STD-1840 Declaration File | 53 |
| Table 3-7 | MIL-STD-1840 Headers | 53 |
| Table 3-8 | File Name Summary | 56 |

## LIST OF ACRONYMS

| | |
|---|---|
| ANSI | American National Standards Institute |
| AP_SPEC | Component Applicable Specification |
| ASCII | American Standard Code for Information Interchange |
| BNF | Backus-Naur Format |
| BOM | Bill of Material |
| CAD | Computer Aided Design |
| CAE | Computer Aided Engineering |
| CCITT | Consultative Committee International Telegraph & Telephone |
| CHTYP_LT | Component Logic Type |
| CHTYP_NTL | Component Negative Tolerance |
| CHTYP_PTL | Component Positive Tolerance |
| CHTYP_VAL | Component Value |
| CLASS | Component Classification |
| COMP_PWR | Component Power |
| COTS | Commercial-Off-The-Shelf-Software |
| EDIF | Electronic Data Interchange Format |
| EIA | Electrical Institute Associate |
| FSCM | Federal Supply Code for Manufacturers |
| FSD | Formal Syntax Definition |
| GPN | Component Generic Part Name |
| IGES | Initial Graphics Exchange Specification |
| IPC | Institute for Interconnecting and Packaging Electronic Circuits |
| IPO | IGES/PDES Organization |
| ISF | Industry Standard File |
| ITEM | Component Item Number |
| LEAD_MAT | Component Lead Material |
| LEAD_PLT | Component Lead Plating |
| MAX_WRK_VOLT | Component Maximum Working Voltage |
| ME | Manufacturing Engineering |
| MIL | Military |
| PCB | Printed Circuit Board |
| PDDD | Printed Data Definition Document |
| PDES | Product Data Exchange Using STEP |
| PKG | Component Package |
| PN | Component Part Number |
| PTYPE | Component Part Type |
| PWA | Printed Wiring Assembly |
| PWB | Printed Wiring Board |
| QNTY | Component Quantity |
| RAMP | Rapid Acquisition of Manufactured Parts |
| RDES | Reference Designator |
| REV | Component Revision Level |
| RPTS | RAMP Product Data Translation System |
| SCRA | South Carolina Research Authority |

## LIST OF ACRONYMS (CONT'D)

| | |
|---|---|
| SI | System International |
| SOLDERABILITY | Component Lead Solderability |
| STD | Standard |
| SUB | Component SubClassification |
| TDP | Technical Data Package |
| 3D | Three Dimensional |
| 2D | Two Dimensional |

RECORD OF CHANGES

| CHANGE NUMBER | CHANGE DATE | PAGES AFFECTED | COMMENT |
|---|---|---|---|
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# SECTION 1.0

## 1.1 SCOPE

This Rapid Acquisition of Manufactured Parts (RAMP)Product Data Translation System (RPTS) Printed Wiring Assembly (PWA) Product Data Definition Document (PDDD) establishes the digital standards and formats used in Technical Data Package (TDP) information for a PWA manufacturing facility.

## 1.2 Purpose

The purpose of the RPTS PWA PDDD is to provide a complete description of the RAMP Product Data File Set which uses industry standards to carry PWA product data.

## 1.3 Introduction

The information required to manufacture a PWA can be grouped into the following major areas and are referenced in the adjoining sections:

| MAJOR AREA | REFERENCE SECTION |
|---|---|
| Schematic | 3.1 Schematic Electrical Functional Product Data |
| Assembly | 3.3 3D Assembly Product Data |
| Bill-of-Material | 3.1.8 EDIF RAMP Test Entities |
| Test Requirements | 3.1.8 EDIF RAMP Test Entities |
| | 3.4 Raster Data |
| Artwork | 3.2 PWB Product Data |
| Component Source Control | 3.4 Raster Data |
| Component Specification control | 3.4 Raster Data |
| MIL standards | 3.4 Raster Data |

## 1.4 Application

The files produced using this specification will provide sufficient PWA product data to support the RAMP PWA factory. Electronic Data Interchange Format (EDIF), Institute for Interconnecting & Packaging of Electronic Circuits (IPC),

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Initial Graphics Exchange Specification (IGES), and Consultative Committee of International Telegraph & Telephone (CCITT) are used by RPTS PWA to deliver data to support the RAMP PWA factory (see Table 1-1). EDIF is used to deliver the PWA schematic and component property data; IPC is used to deliver Printed Wiring Board (PWB) artwork and other Two Dimensional (2D) PWB data; and IGES is used to deliver PWA Three Dimensional (3D) assembly and component data.

TABLE 1-1

PRODUCT DATA AND RELATED STANDARDS

| PRODUCT DATA TYPE | EDIF | IGES | IPC | CCITT GP 4 |
|---|---|---|---|---|
| SCHEMATIC | X | | | X |
| BARE PWB | | X | X | X |
| AS RECEIVED COMPONENT | | X | | X |
| ASSEMBLY | | X | | X |
| TEST REQUIREMENTS | X | | | X |
| COMPONENT SOURCE CONTROL | | | | X |
| COMPONENT DETAIL SPEC. | | | | X |

## 1.5 Terms and Abbreviations

**Schematic.** An electrical or logical schematic contains graphical component symbols representing the components within a PWA, connection point symbols representing component electrical connection ports, interconnecting lines representing electrical interconnects or nets between the components and other system assemblies, and American Standard Code for Information Interchange (ASCII) text representing component properties attribute names and values.

**Orientation Vector.** The orientation vector is a line segment placed in the body of a 3D component model can be used to determine the orientation of the component when the component is placed in the 3D assembly model.

# SECTION 2.0
# APPLICABLE DOCUMENTS

## Government Documents

Unless otherwise specified, the following specifications and standards of the issue listed shall form a part of this specification to the extent specified herein.

### SPECIFICATIONS:

| | |
|---|---|
| MIL-D-28000 | Digital Representation for Communication of Product Data |
| MIL-R-28002 | Rasters Graphics Representations in Binary Format, Requirements for |

### STANDARDS:

| | |
|---|---|
| MIL-STD-1840 | Automated Interchange of Technical Information |
| MIL-STD-275 | Printed Wiring for Electronic Equipment |

### HANDBOOKS:

| | |
|---|---|
| MIL-HDBK-59 | CALS Program Implementation Guide |

### INDUSTRY STANDARDS DOCUMENTS:

| | |
|---|---|
| ANSI/EIA RS548 | EDIF 2 0 0 Electronic Data Interchange Format |
| ANSI/IPC-D-350 | IPC Printed Board Description in Digital Form |
| ANSI/IPC-D-353 | IPC Test Standard |
| ANSI/IGES | IGES 4.0/5.0 Initial Graphics Exchange Specification |
| ANSI/EIA 538 | CCITT GROUP 4 Consultative Committee of International Telegraph & Telephone on Raster Data Communication and Compression |

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# SECTION 3.0
# RAMP PWA PRODUCT DATA DEFINITION

## 3.1 Schematic Electrical Functional Product Data

EDIF 2 0 0, which is American National Standards Institute (ANSI)/Electrical Institute Associate (EIA) RS548, is used to supply the electrical schematic and component information to the RAMP PWA factory. This is made possible by the RPTS data capture system and RAMP PWA Manufacturing Engineering (ME) Computer Aided Design (CAD) and Computer Aided Engineering (CAE) system support EDIF 2 0 0 Schematic View. The schematic, electrical attributes, and component values are used by the factory to facilitate automation of test generation and fixturing as shown in Figure 3-1. The attribute list for electrical properties shall be transferred to the factory in EDIF format and uses keyword attributes from IGES 5.0, IPC-D-353, and RAMP.

### 3.1.1 EDIF Cells

The EDIF standard uses a cellular structure which represents the PWA schematic as one cell and its constituent subassembly components as cells within the main PWA cell. There are three EDIF cell type attributes used in RAMP which define the use of a cell: generic, tie, and ripper as follows:

The generic cell type is used for defining a component or whole assembly.

The tie cell type is used in explicitly joining subnets with nets.

The ripper cell type is used to explicitly merge nets with different names, and make changes to nets which may occur in the contents or page constructs.

### 3.1.2 EDIF Views

Each CELL whether referencing the whole assembly or an individual component on the assembly could have ten different VIEWS of the CELL as modeled in EDIF but only the "Schematic" and "Netlist" views are used by RAMP.

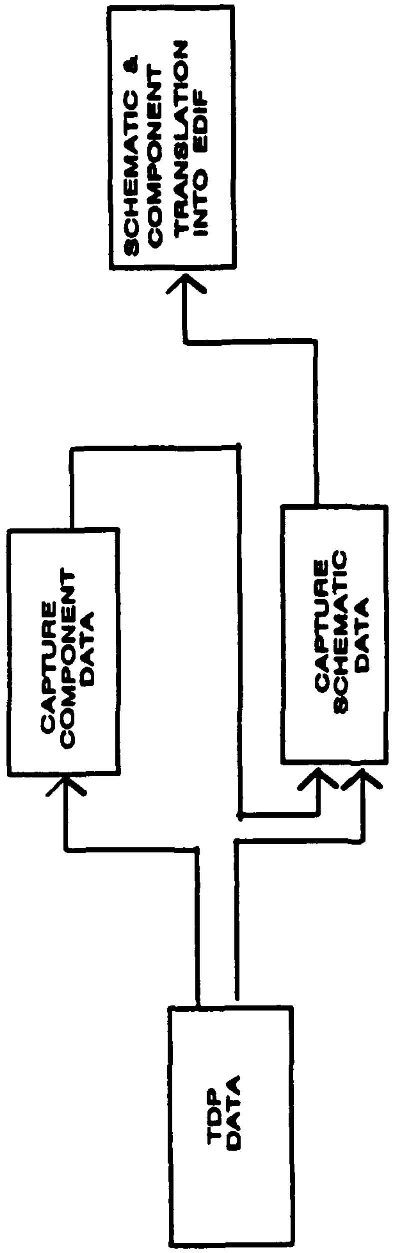


FIGURE 3-1 EDIF SCHEMATIC & COMPONENT DATA

0148KG

### 3.1.2.1 View Interface

Within the EDIF views, there is an interface entity to define the cell interaction within its external environment. The following constructs are legal and defined in EDIF for interface.

interface
a. port
b. portbundle
  (1) symbol
  (2) protectionFrame
  (3) arrayRelatedInfo
c. parameter
d. joined
e. mustJoin
f. weakJoined
g. permutable
h. timing
i. simulate
  designator
j. property
k. comment
l. userData

### 3.1.2.2 View Contents

The optional contents entity defines internal details of a view. The entity is used as required for each cell to provide comment, property and user data statements to describe the components for the applications supported. The contents section of EDIF details the implementation of a view and uses the following constructs as defined in EDIF 2 0 0:

a. instance
b. offpageconnector
c. figure
d. section
e. net
f. netbundle
g. page
h. commentGraphics
i. portImplementation
j. timing
k. simulate
l. when
m. follow
n. logicPort

boundingBox
o. userData

3.1.2.3 ViewMap

ViewMap is used in EDIF to express relationships between objects of the same type in different views, but is not supported in RAMP PWA.

3.1.3 EDIF Level

EDIF has three levels 0, 1, and 2 which allow passing data, with progressively more complex numeric representations possible with the higher level. Level 0 is used in RAMP PWA.

3.1.4 EDIF Technology

The technology of the components used in the PWA is defined in EDIF by the Technology entity. The Technology entity contains data on scaling, basic figure groups, and display formats. The EDIF graphic units are in System International (SI) which is a metric convention.

3.1.5 EDIF Libraries

The cells used in EDIF are grouped into libraries based on common characteristics. Besides the three basic cells found in the library there are also edif level and technology data.

3.1.6 EDIF Object Relationships

In EDIF, relationships between objects are expressed by name reference and containment.

3.1.6.1 Name Relationships

SUPPORTED EDIF NAME

| CLASS | SCOPING CONSTRUCT |
|---|---|
| cellName | external, library |
| designName | edif |
| edifFileName | no scope |
| figureGroupName | library |
| instanceName | net, page, view |
| libraryName | edif |
| netName | net, netbundle, page, view |
| portName | portbundle, simulate, view |
| propertyName | containing form |
| ruleName | library |
| simulateName | view |
| valueName | block, external, library, page, view |
| viewName | cell |

3.1.6.2 Containment Relationships

Parentheses are used to group data concerning a particular object. For example:

```
(property PTYPE
  (string "SSI")
  (owner "Intergraph"))
```

3.1.7 EDIF FigureGroups

FigureGroups are the basic entity used for describing sets of geometry such as schematic symbols or text.

3.1.8 EDIF RAMP Test Entities

3.1.8.1 Component Part Type (PTYPE)

The PTYPE attribute indicates the part type assigned to a part or component of a PWA. PTYPE is also referenced in IPC-D-353, a draft test standard for data communication. The PTYPE attribute is used in incircuit test systems to select the type of test to generate for discrete analog components. The value of PTYPE is a alpha numeric string not to exceed 15 characters in length with the formal syntax shown in Appendix I. The following part types are reserved for PTYPE use:

| Name | Meaning |
|---|---|
| ANA | ANALOG INTEGRATED CIRCUIT |
| BIZ | BIZENER |
| CAP | CAPACITOR |
| CSW | CLOSED SWITCH |
| CUST | CUSTOM INTEGRATED CIRCUIT |
| DAR | DARLINGTON TRANSISTOR |
| DIO | DIODE |
| DIPCAP | DIP CAPACITOR |
| EDG | EDGE CONNECTOR |
| FET | FIELD EFFECT TRANSISTOR |
| FUS | FUSE |
| HYB | HYBRID |
| IND | INDUCTOR |
| JUM | JUMPER |
| LED | LIGHT EMITTING DIODE |
| LSI | LARGE SCALE INTEGRATION |
| MSI | MEDIUM SCALE INTEGRATION |
| OPJ | OPEN JUMPER |
| OSW | OPEN SWITCH |
| PCA | POLARIZED CAPACITOR |
| PIS | PACKAGING/INTERCONNECTING STRUCTURE |

| | |
|---|---|
| POT | POTENTIOMETER |
| PWB | PRINTED WIRING BOARD |
| RCL | RELAY COIL |
| RCNO | RELAY CONTACT NORMALLY OPEN |
| RCNC | RELAY CONTACT NORMALLY CLOSED |
| RES | RESISTOR |
| RHE | RHEOSTAT |
| RP_DB | RESISTOR PACK DIP BUSSED |
| RP_DH | RESISTOR PACK DIP HYBRID |
| RP_DI | RESISTOR PACK DIP ISOLATED |
| RP_DT | RESISTOR PACK DIP TERMINATED |
| RP_SB | RESISTOR PACK SIP BUSSED |
| RP_SH | RESISTOR PACK SIP HYBRID |
| RP_SI | RESISTOR PACK SIP ISOLATED |
| RP_ST | RESISTOR PACK SIP TERMINATED |
| SCR | SILICON CONTROLLED RECTIFIER |
| SSI | SMALL SCALE INTEGRATION |
| TCA | TANTALUM CAPACITOR |
| TPCP | TWO PART CONNECTOR PIN |
| TPCS | TWO PART CONNECTOR SOCKET |
| TRAS | TRANSFORMER SIGNAL |
| TRAP | TRANSFORMER POWER |
| TRNN | TRANSISTOR NPN |
| TRNP | TRANSISTOR PNP |
| UNI | UNIJUNCTION TRANSISTOR |
| VHSIC | VERY HIGH SPEED INTEGRATED CIRCUIT |
| VLSI | VERY LARGE SCALE INTEGRATION |
| XTL | CRYSTAL |
| ZDI | ZENER DIODE |

Example of usage in the EDIF file after translation:

```
    (property PTYPE
(string "SSI")
(owner "Intergraph"))
```

### 3.1.8.2 Reference Designator (RDES)

The RDES attribute indicates the specific reference designator assigned to a part or component of a PWA. RDES is also referenced in IPC-D-353. The RDES attribute is used in incircuit test systems to identify faulty components. The formal syntax is given in Appendix I.

<RDES> {U5}

Example of usage in the EDIF file after translation:

```
    (property RDES
(string "U5")
(owner "Intergraph"))
```

### 3.1.8.3 Component Value (CHTYP_VAL)

The CHTYP_VAL attribute indicates a general value characteristic assigned to a part or component such as a resistor, capacitor, or inductor. CHTYP and VAL are also referenced in IPC-D-353. The CHTYP_VAL attribute is used in incircuit test systems to set up the analog measurement range. The formal syntax is given in Appendix I.

The percent sign "%" and units of the value are not allowed in the value field.

Example of usage in the EDIF file after translation:

```
(property CHTYP_VAL
      (string (stringdisplay "2.2K"
  (display
     (figuregroupoverride TEXT1_GROUP
      (visible (false)))
       (justify UPPERLEFT)
       (orientation R0)
       (origin (pt 128600 61850)))))
     (owner "Intergraph"))
```

### 3.1.8.4 Component Positive Tolerance (CHTYP_PTL)

The CHTYP_PTL attribute indicates the positive tolerance characteristic of the nominal value assigned to a part or component of a PWA. The tolerance is given as percentage of the general value. CHTYP and PTL are also used in IPC-D-353, a draft standard for data communication. The CHTYP_PTL attribute is used in incircuit test systems to convey the positive tolerance used to determine if an analog part passes or fails the test. The percent sign "%" is not allowed in the value field. The formal syntax is given in Appendix I.

Example of usage in the EDIF file after translation:

```
(property CHTYP_PTL
        (string (stringdisplay "5"
        (display
        (figuregroupoverride TEXT1_GROUP
        (visible (false)))
            (justify UPPERLEFT)
                (orientation R0)
                (origin (pt 128600 63050)))))
    (owner "Intergraph"))
```

### 3.1.8.5 Component Type Negative Tolerance (CHTYP_NTL)

The CHTYP_NTL attribute indicates the negative tolerance characteristic of the nominal value assigned to a part or component of a PWA. The tolerance is given as a percentage of the general value. CHTYP and NTL are also used IPC-D-353, a test standard for data communication. The CHTYP_NTL attribute is used in incircuit test systems to convey the negative tolerance used to determine if an analog part passes or fails the test. The percent sign "%" and minus sign are not allowed in the value field. The formal syntax is given in Appendix I.

Example of usage in the EDIF file after translation:

```
(property CHTYP_NTL
        (string (stringdisplay "5"
    (display
    (figuregroupoverride TEXT1_GROUP
        (visible (false)))
     (justify UPPERLEFT)
       (orientation R0)
      (origin (pt 128600 62450)))))
     (owner "Intergraph"))
```

### 3.1.8.6 Component Generic Part Name (GPN)

The GPN attribute indicates a generic part name attribute assigned to a part or component of a PWA. The GPN is located in the schematic near or on the component symbol. The GPN is used in Incircuit test to select the generic library test model of a component. The formal syntax is shown in Appendix I.

Example of usage in the EDIF file after translation:

```
(property GPN
    (string "5476")
(owner "Intergraph"))
```

### 3.1.8.7 Component Logic Type (CHTYP_LT)

The CHTYP_LT attribute indicates a logic type characteristic assigned to a part or component of a PWA. IPC-D-353 is a supporting reference for this definition. The CHTYP_LT is used in Incircuit test to select the analog or digital generic test model library. The formal syntax is given in Appendix I.

The following part types are reserved for CHTYP_LT use:

| Name | Meaning |
|---|---|
| ALU | Arithmetic logic Unit |
| ANA | Analog |
| CLK | Clock Generator |
| CNT | Counter |
| COM | Combinatorial Logic |
| DMUX | Demultiplexer |
| DRAM | Used for Dynamic RAMs |
| HYB | Hybrid |
| MUX | Multiplexer |
| PIO | Programmable I/O |
| PLD | Programmable Logic Device |
| RAM | Memory Devices |
| ROM | Read Only Memory |
| SEQ | Sequential Logic |
| SRAM | Used for Static RAMs (Random Access Memory) |

Example of usage in the EDIF file after translation:

```
    (property CHTYP_LT
  (string "SEQ")
(owner "Intergraph"))
```

### 3.1.8.8 Component Applicable Specification (AP_SPEC)

The Applicable Specification Number attribute indicates the specification document number that describes the component. The AP_SPEC is located in the TDP Bill of Material (BOM)/Parts List in column 13 as defined by DOD-STD-100C. The formal syntax is given in Appendix I.

Example of usage in the EDIF file after translation:

```
    (property AP_SPEC
  (string "MIL-R_39008/1")
(owner "Intergraph"))
```

### 3.1.8.9 Component Part Number (PN)

The Part Number attribute indicates the part number which identifies the component. The PN is located in the TDP BOM/Parts List in column 14 as defined by DOD-STD-100C. The formal syntax is given in Appendix I.

Example of usage in the EDIF file after translation:

```
    (property PN
  (string "RCR07G222JM")
(owner "Intergraph"))
```

3.1.8.10 Component Item Number (ITEM)

The Item Number attribute indicates the item number which is uniquely assigned to a component part number in a design as an internal identification number.

The Item number is located in the TDP BOM/Parts List in column 9 as defined by DOD-STD-100C. The formal syntax is given in Appendix I.

Example of usage in the EDIF file after translation:

```
(property ITEM
  (string "38")
  (owner "Intergraph"))
```

3.1.8.11 Commercial And Government Entity Code (CAGE)

The CAGE Identification Code attribute indicates the Identification Code assigned to the design activity who made the component. The CAGE is located in the TDP BOM/Parts List in column 12 as defined by DOD-STD-100C. The formal syntax is given in Appendix I.

Example of usage in the EDIF file after translation:

```
(property CAGE
  (string "10001")
  (owner "Intergraph"))
```

3.1.8.12 Component Classification (CLASS)

The Component Classification is a component attribute which divides different components into one of 12 basic classes used in manufacturing. The formal syntax is given in Appendix I. CLASS is a South Carolina Research Authority (SCRA) developed classification system. The component classes are listed below in Table 3-1:

TABLE 3-1
COMPONENT CLASSIFICATION

| CLASS | MEANING |
|---|---|
| BATTE | BATTERY |
| CAP | CAPACITOR |
| CHEM | CHEMICAL |
| CON | CONDUCTOR |
| CORE | CORE |
| HDWR | HARDWARE |
| IND | INDUCTOR |
| LAMP | ILLUMINATORS |
| PWB | PRINTED WIRING BOARD |
| RES | RESISTOR |
| ROTMA | ROTATING MACHINERY |
| SEMI | SEMICONDUCTOR |
| SWTCH | SWITCH_RELAY |

TABLE 3-1 (CONT'D)
COMPONENT CLASSIFICATION

| CLASS | MEANING |
|---|---|
| TRADU | TRANSDUCER |
| UCKT | MICROCIRCUIT |
| XFMR | TRANSFORMER |

Example of usage in the EDIF file after translation:

```
    (property CLASS
  (string "PWB")
(owner "Intergraph"))
```

3.1.8.13 Component SubClassification (SUB)

The Component SubClassification is a component attribute which divides different components classifications into subclassifications. Each of the 12 basic classes has its own group of subclasses. The formal syntax is given in Appendix I. SUB is a SCRA developed subclassification system. The component subclasses are listed in Table 3-2.

TABLE 3-2
COMPONENT SUB-CLASSIFICATION

| CLASS | SUB | MEANING |
|---|---|---|
| BATTE | NONR | Nonrechargable |
| | RECH | Rechargeable |
| CAP | FIXED | Fixed Value Capacitor |
| | VAR | Variable Value Capacitor |
| CHEM | BAGT | Bonding Agent |
| | CAGT | Compound Agent |
| | CLAGT | Cleaning Agent |
| | IAGT | Insulating Agent |
| | MAGT | Marketing Agent |
| | TAGT | Thermal Agent |
| CON | ANTEN | Antenna |
| | BUSBR | Busbar |
| | EDGE | Edge Connector |
| | FUSE | Fuse |
| | JUM | Jumper |
| | OPJ | Open Jumper |
| | COAX | Coaxial Cable |
| | WAVG | Waveguide |
| | PLUG | Connector Plug |
| | RECPT | Connector Receptacle |
| | EDGE | Edge Connector |
| | TERM | Terminal Connector |
| | TP | Test Point |
| | KEY | Keyed Connector |
| | ADAPT | Adaptor Connector |
| CORE | FEBED | Ferrite Bead Core |
| HDWR | BOLT | Bolt |

TABLE 3-2 (CONT'D)
COMPONENT SUB-CLASSIFICATION

| CLASS | SUB | MEANING |
|---|---|---|
| | BRACK | Bracket |
| | BRVT | Blind Rivet |
| | CLAMP | Clamp |
| | CRVT | Countersink Rivet |
| | CLIP | Clip |
| | EJECT | Ejector |
| | EYELE | Eyelet |
| | FRAME | Frame |
| | FWSHR | Flat Washer |
| | LWSHR | Lock Washer |
| | HANDL | Handle |
| | LOBAR | Locking Bar |
| | PUBAR | Pull Bar |
| | INSUL | Disk Insulator |
| | PAD | Pad Insulator |
| | PLATE | Plate Insulator |
| | WASHR | Washer Insulator |
| | NUT | Nut |
| | PIN | Alignment Pin |
| | SPRIN | Spring Pin |
| | RRING | Retaining Ring |
| | TIES | Ties |
| | TRVT | Tubular Rivet |
| | SCREW | Screw |
| | SHIEL | Shield |
| | SLEEV | Sleeve |
| | SPACE | Spacer |
| | SPREA | Spreader |
| | SPRIN | Spring |
| IND | FIXED | Fixed Value Inductor |
| | VAR | Variable Value Inductor |
| LAMP | FLOUR | Fluorescent |

TABLE 3-2 (CONT'D)
COMPONENT SUBCLASSIFICATION

| CLASS | SUB | MEANING |
|---|---|---|
| | GLOW | Glow Cold Cathode Lamp |
| | INCAN | Incandescent |
| | BALLA | Ballast Lamp |
| PWB | FLEX | Flexible Printed Wiring Board |
| | HYB | Hybrid Printed Wiring Board |
| | MOLD | Molded Printed Wiring Board |
| | RFLEX | Reflex Printed Wiring Board |
| | RIGID | Rigid Printed Wiring Board |
| RES | FIXED | Fixed Resistor |
| | VAR | Variable Resistor |
| ROTMA | ACMAC | AC Rotating Machinery |
| | DCMAC | DC Rotating Machinery |
| | SYNCH | Synchronous |
| SEMI | DIODE | Diode |
| | SCR | Silicon Controlled Rectifier |
| | TRANS | Transistor |
| SWTCH | RELAY | Relay Switch |
| | SWTCH | Switch |
| TRADU | BELL | Bell Transducer |
| | HALL | Hall Effect Transducer |
| | MIC | Microphone Transducer |
| | SPK | Speaker Transducer |
| | XTL | CRYSTAL Transducer |
| UCKT | DIG | Digital Microcircuit |
| | HYB | Hybrid or Custom Microcircuit |
| | LIN | Analog Microcircuit |
| | MIXED | Mixed Analog/Digital Microcircuit |
| XFMR | POWER | Power Transformer |
| | SIGNAL | Signal Transformer |

Example of usage in the EDIF file after translation:

```
      (property SUB
    (string "TMSTR")
  (owner "Intergraph"))
```

### 3.1.8.14 Component Package (PKG)

The PKG is a component attribute which divides different component package styles into one of 12 basic classes used in manufacturing. The formal syntax is given in Appendix I. PKG is a SCRA developed package classification system. The component PKG types are listed in Table 3-3.

TABLE 3-3
Component Package

| PKG | MEANING |
|---|---|
| TYPE1 | Single Layer PWB |
| TYPE2 | Double Layer PWB |
| TYPE3 | Multilayer without blind or buried vias |
| TYPE4 | Multilayer with blind or buried vias |
| TYPE5 | Multilayer metal core w/o blind or buried vias |
| TYPE6 | Multilayer metal core with blind or buried vias |
| AXIAL | Package with Axial Leads |
| RDL | Package with Radial Leads |
| FP | Flat Package |
| SIP | Single In Line Package |
| DIP | Dual In Line Package |
| CHIP | Surface Mount Chip |
| CAN | Metal Encapsulated |
| LCC | Leadless Chip Carrier |
| JCC | J Bend Leaded Chip Carrier |
| GCC | Gull Winged Chip Carrier |
| PGA | Pin Grid Array |
| COB | Chip On Board |
| TAB | Tape Automated Bonding |
| SOIC | Small Outline Integrated Circuit |
| BOTTL | Bottle |
| DRUM | Drum |
| TUBE | Tube |
| TOROI | Toroid |

Example of usage in the EDIF file after translation:

```
(property PKG
(string "SOIC")
(owner "Intergraph"))
```

3.1.8.15 Component Maximum Working Voltage (MAX_WRK_VOLT)

The MAX_WK_VOLT property is a component's maximum rated working voltage. Acceptable entries are positive values (for example 100, .5 ) in volts.

Example of usage in the EDIF file after translation:

```
(property MAX_WRK_VOLT
  (string "25")
(owner "Intergraph"))
```

3.1.8.16 Component Power (COMP_PWR)

The COMP_PWR property is a component's power rating. COMP_PWR is a SCRA developed classification attribute. Acceptable entries are positive values (for example: ".25","500") in watts.

Example of usage in the EDIF file after translation:

```
(property COMP_PWR
  (string ".25")
(owner "Intergraph"))
```

3.1.8.17 Component Lead Solderability (SOLDERABILITY)

*The SOLDERABILITY property indicates whether a component can be wave* soldered or reflow soldered. SOLDERABILITY is a SCRA developed classification attribute. The component specification defines solderability. The acceptable entries are "NIL", "NRFLO", "NOWAV", and "NWRF".

Example of usage in the EDIF file after translation:

```
(property SOLDERABILITY
  (string "NRFLO")
(owner "Intergraph"))
```

3.1.8.18 Component Lead Material (LEAD_MAT)

The component lead material property provides the lead composition. LEAD_MAT is a SCRA developed classification attribute. The acceptable entries are "STL" or "OTH".

Example of usage in the EDIF file after translation:

```
(property LEAD_MAT
  (string "STL")
(owner "Intergraph"))
```

3.1.8.19 Component Lead Plating (LEAD_PLT)

The component lead plating property indicates whether gold was used to plate the leads of a component. LEAD_PLT is a SCRA developed classification attribute. The acceptable entries are "GLD" or "OTH".

Example of usage in the EDIF file after translation:

```
        (property LEAD_PLT
     (string "GLD")
  (owner "Intergraph"))
```

3.1.8.20 Component Quantity (Qnty)

The Qnty attribute indicates quantity of a component used per instance. The formal syntax is given in Appendix I. The QNTY is derived from the BOM information on quantity of a piece part, one item (1), Not Specified (NS), As Required (AR). QNTY is a SCRA developed classification attribute.

Example of usage in the EDIF file after translation:

```
        (property QNTY
     (string "AR")
  (owner "Intergraph"))
```

3.1.8.21 Component Revision Level (REV)

The REV attribute indicates alpha numeric phrase entered to describe the component revision level. The formal syntax is given in Appendix I. REV is a SCRA developed classification attribute. The REV is located in the component specifications.

Example of usage in the EDIF file after translation:

```
        (property REV
     (string "A")
  (owner "Intergraph"))
```

3.1.8.22 Quantity Unit (QUNIT)

The Qnty Unit (QUNIT) attribute indicates unit of quantity of a component used per instance. The formal syntax is given in Appendix I. The QUNIT is derived from the BOM information on quantity of a piece part, each (EA), inches (IN), feet (FT), ounces (OZ), pound (LB), centimeter (CM), kilometer (KM), millimeter (MM), liter (L), pint (PT), quart (QT), gallon (GAL).

QUNIT is a SCRA developed classification attribute.

Example of usage in the EDIF file after translation:

```
(property QUNIT
(string "IN")
(owner "Intergraph"))
```

### 3.1.9 EDIF File

The EDIF capture file is job.edf and is found in the 1840 header record: "dstdocid: ".

## 3.2 Printed Wiring Board

The 2D layout, commonly referred to as PWB data, is the data required to fabricate the PWB and is supplied to a RAMP PWA factory using IPC-D-350 and IGES files. The data describe the traces and component pad shapes, and their locations for each layer of the board. The X,Y coordinate locations for pads and holes on the board are included. Any fabrication information concerning board dimensions, material, composition, and tolerances is included. The fabrication drawings are also included in Raster form from the original TDP. The PWB information as shown in Figure 3-2 is translated into IPC-D-350.

### 3.2.1 IPC Entity Usage

The IPC-D-350 operations codes that are used by RAMP Product Data descriptions of the PWB are described in the following paragraphs.

#### 3.2.1.1 General Records

The following IPC-D-350 operations codes are used by RAMP product data:

| IPC OPERATIONS CODES | DESCRIPTION |
|---|---|
| 000 | Continuation in Present Mode |
| 999 | End of Job |

#### 3.2.1.2 Line Records

The following IPC-D-350 line records operations codes are used by RAMP product Data:

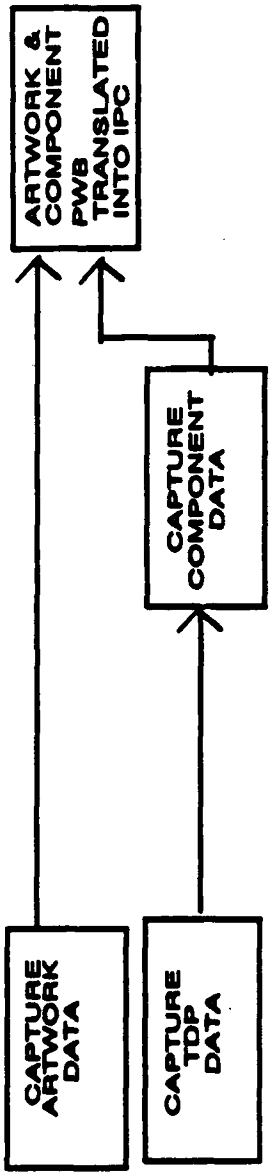


FIGURE 3-2 IPC PWB DATA

| IPC OPERATIONS CODES | DESCRIPTION |
|---|---|
| 111 | Begin New Line using Linear Interpolation and Position Data formatted as three adjacent X and Y fields |
| 112 | Begin New Line using Linear Interpolation and Position Data formatted as two adjacent X and Y fields |
| 113 | Begin New Line using Linear Interpolation and Position Data formatted as two adjacent XYZ fields |
| 114 | Begin New Line using Linear Interpolation and Position Data formatted as one set of XYZ fields |
| 121 | Begin New Line using Circular interpolation and Position Data formatted as three adjacent X and Y fields |
| 122 | Begin New Line using Circular interpolation and Position Data formatted as two adjacent X and Y fields |
| 123 | Begin New Line using Circular interpolation and Position Data formatted as two adjacent XYZ fields |
| 124 | Begin New Line using Circular interpolation and Position Data formatted as one set of XYZ fields |
| 141 | Begin New Line using Linear "paint in" area out line and Position Data formatted as three adjacent X and Y fields |
| 142 | Begin New Line using Linear "paint in" area out line and Position Data formatted as two adjacent X and Y fields |
| 143 | Begin New Line using Linear "paint in" area out line and Position Data formatted as two adjacent XYZ fields |
| 144 | Begin New Line using Linear "paint in" area out line and Position Data formatted as one set of XYZ fields |

| | |
|---|---|
| 151 | Begin New Line using Circular part outline and Position Data formatted as three adjacent X and Y fields |
| 152 | Begin New Line using Circular part outline and Position Data formatted as two adjacent X and Y fields |
| 153 | Begin New Line using Circular part outline and Position Data formatted as two adjacent XYZ fields |
| 154 | Begin New Line using Circular part outline and Position Data formatted as one set of XYZ fields |
| 171 | Begin New Line using Linear part outline and Position Data formatted as three adjacent X and Y fields |
| 172 | Begin New Line using Linear part outline and Position Data formatted as two adjacent X and Y fields |
| 173 | Begin New Line using Linear part outline and Position Data formatted as two adjacent XYZ fields |
| 174 | Begin New Line using Linear part outline and Position Data formatted as one set of XYZ fields |
| 181 | Begin New Line using Circular part outline and Position Data formatted as three adjacent X and Y fields |
| 182 | Begin New Line using Circular part outline and Position Data formatted as two adjacent X and Y fields |
| 183 | Begin New Line using Circular part outline and Position Data formatted as two adjacent XYZ fields |
| 184 | Begin New Line using Circular part outline and Position Data formatted as three XYZ fields |

### 3.2.1.3 Subroutine Definition Records

The following IPC-D-350 subroutine definition operations codes are used by RAMP product Data:

| IPC OPERATIONS CODES | DESCRIPTION |
|---|---|
| 211 | Begin subroutine definition using a complex feature and Position Data formatted as three adjacent X and Y fields |
| 212 | Begin subroutine definition using a complex feature and Position Data formatted as two adjacent X and Y fields |
| 213 | Begin subroutine definition using a complex feature and Position Data formatted as two adjacent XYZ fields |
| 214 | Begin subroutine definition using a complex feature and Position Data formatted as one set of XYZ fields |
| 221 | Begin subroutine definition using Circular interpolation and Position Data formatted as three adjacent X and Y fields |
| 222 | Begin subroutine definition using Circular interpolation and Position Data formatted as two adjacent X and Y fields |
| 223 | Begin subroutine definition using Point Record special shape (G4) and Position Data formatted as two adjacent XYZ fields |
| 224 | Begin subroutine definition using Point Record special shape (G4) and Position Data formatted as one set adjacent XYZ fields |
| 299 | End of subroutine |

### 3.2.1.4 Point Records

The following IPC-D-350 point records operations codes are used by RAMP product Data:

| IPC OPERATIONS CODES | DESCRIPTION |
|---|---|
| 311 | Begin New point record using Feature (land), hole concentric at a point and Position Data formatted as three adjacent X and Y fields |
| 312 | Begin New point record using Feature (land), hole concentric at the point, and Position Data formatted as two adjacent X and Y fields |
| 313 | Begin New point record using Feature (land), hole concentric at the point, and Position Data formatted as two adjacent XYZ fields |
| 314 | Begin New point record using Feature (land), hole concentric at the point, and Position Data formatted as one set of XYZ fields |
| 321 | Begin New point record using Feature (land) only at a point and Position Data formatted as three adjacent X and Y fields |
| 322 | Begin New point record using Feature (land) only at a point and Position Data formatted as two adjacent X and Y fields |
| 323 | Begin New point record using Feature (land) only at a point and Position Data formatted as two adjacent XYZ fields |
| 324 | Begin New point record using Feature (land) only at a point and Position Data formatted as one set of XYZ fields |
| 331 | Begin New point record using Hole only at a point and Position Data formatted as three adjacent X and Y fields |
| 332 | Begin New point record using Hole only at a point and Position Data formatted as two adjacent X and Y fields |

| | |
|---|---|
| 333 | Begin New point record using Hole only at a point and Position Data formatted as two adjacent XYZ fields |
| 334 | Begin New point record using Hole only at a point and Position Data formatted as three XYZ fields |
| 341 | Begin New point record using Tooling feature with hole at the point and Position Data formatted as three adjacent X and Y fields |
| 342 | Begin New point record using Tooling feature with hole at the point and Position Data formatted as two adjacent X and Y fields |
| 343 | Begin New point record using Tooling feature with hole at the point and Position Data formatted as two adjacent XYZ fields |
| 344 | Begin New point record using Tooling feature with hole at the point and Position Data formatted as one set of XYZ fields |
| 351 | Begin New point record using Tooling feature only at a point and Position Data formatted as three adjacent X and Y fields |
| 352 | Begin New point record using Tooling feature only at a point and Position Data formatted as two adjacent X and Y fields |
| 353 | Begin New point record using Tooling feature only at a point and Position Data formatted as two adjacent XYZ fields |
| 354 | Begin New point record using Tooling feature only at a point and Position Data formatted as one set of XYZ fields |
| 361 | Begin New point record using Tooling hole only at the point and Position Data formatted as three adjacent X and Y fields |
| 362 | Begin New point record using Tooling hole only at the point and Position Data formatted as two adjacent X and Y fields |

| | |
|---|---|
| 363 | Begin New point record using Tooling hole only at the point and Position Data formatted as two adjacent XYZ fields |
| 364 | Begin New point record using Tooling hole only at the point and Position Data formatted as one set of XYZ fields |

### 3.2.1.5 Subroutine Call Records

The following IPC-D-350 subroutine call records operations codes are used by RAMP product Data:

| IPC OPERATIONS CODES | DESCRIPTION |
|---|---|
| 411 | Begin Subroutine call using a Linear repeat or step-and-repeat and Position Data formatted as three adjacent X and Y fields |
| 412 | Begin Subroutine call using a Linear repeat or step-and-repeat and Position Data formatted as two adjacent X and Y fields |
| 413 | Begin Subroutine call using a Linear repeat or step-and-repeat and Position Data formatted as two adjacent XYZ fields |
| 414 | Begin Subroutine call using a Linear repeat or step-and-repeat and Position Data formatted as one set of XYZ fields |
| 421 | Begin subroutine call using Rotary repeat or step-and-repeat and Position Data formatted as three adjacent X and Y fields |
| 422 | Begin subroutine call using Rotary repeat or step-and-repeat and Position Data formatted as two adjacent X and Y fields |
| 423 | Begin subroutine call using Rotary repeat or step-and repeat and Position Data formatted as two adjacent XYZ fields |
| 424 | Begin subroutine call using Rotary repeat or step-and repeat and Position Data formatted as one set of adjacent XYZ fields |

### 3.2.1.6 Annotation Records

The following IPC-D-350 annotation records operations codes are used by RAMP product Data:

| IPC OPERATIONS CODES | DESCRIPTION |
|---|---|
| 511 | Begin Annotation/dimension record using new annotation record and Position Data formatted as three adjacent X and Y fields |
| 512 | Begin Annotation/dimension record using new annotation record and Position Data formatted as two adjacent X and Y fields |
| 513 | Begin Annotation/dimension record using new annotation record and Position Data formatted as two adjacent XYZ fields |
| 514 | Begin Annotation/dimension record using new annotation record and Position Data formatted as one set of XYZ fields |

### 3.2.2 IPC Parameter Records

The following parameters defined by IPC-D-350 are used in the RAMP Product Data file to describe basic PWB information:

| PARAMETER NAME | DESCRIPTION |
|---|---|
| JOB | Job name from CAD database |
| DIM | Data Information Module |
| UNITS | Units of Measurement |
| LAYER | Relates CAD layers to Data layers in the file |
| IMAGE | Indicates whether described features are conductive or non-conductive |
| FAB | Describes PWB Construction materials and thicknesses |

The use of these parameters in RAMP Product Data is described in the following paragraphs.

### 3.2.2.1 Job Parameter

The Job Parameter is the first record in the IPC-D-350 file and indicates the start of the job set. The entry is the PWB fabrication drawing number.

Example of usage in the IPC-D-350 file after translation:

P JOB 74E2N356

### 3.2.2.2 DIM Parameter

The Data Information Module (DIM) Parameter record indicates the start of a Data Information Module, which declares the type of product described by the data set. It appears just after the JOB Parameter record. The DIM Code Letter is taken from IPC-D-350D table 5-2 Record Interrelationship.

Example of usage in the IPC-D-350 file after translation:

P DIM B

### 3.2.2.3 Units Parameter

The Units Parameter indicates the Units of Measurement, either CUST (customary) or SI (metric) represented by the numeric values in the file. It follows the DIM Parameter record.

Example of usage in the IPC-D-350 file after translation:

P UNITS CUST

### 3.2.2.4 Layer Parameter

The PWB is described by the IPC-D-350 file using a series of conductive and nonconductive layers. Each of these layers is made of one or more data layers. The information for each layer is grouped together in the IPC-D-350 file separate from other layers. Just after the UNITS parameter record, a list of LAYER parameters appears which identify the physical PWB layers according to Table 4-1 "Layer Definitions" of IPC-D-350D. For each LAYER parameter, a COMP (compose) parameter exists that specifies which data layers comprise that physical PWB layer. A data layer is a group of geometric patterns that define features such as pad patterns, trace patterns, and power planes. An example of an IPC-D-350 LAYER record is:

P LAYER 03 COMP 11 08 21

In this example record, physical layer 03 which could be a conductive or nonconductive layer is composed of data layers 11, 08, and 21 which could be traces, pads, or other features.

3.2.2.5 Image Parameter

The Image Parameter indicates the type of features being described in the following data records, either COND for conductive features (pads and traces) or NCON for non-conductive features such as silk screens or solder masks.

Example of usage in the IPC-D-350 file after translation:

P IMAGE COND

3.2.2.6 FAB Parameter

Information used to describe the construction of the PWB is contained in the FAB Parameter. This parameter is an IPC-D-350C enhancement not available in IPC-D-350B.

Entity codes included with the FAB parameter are:

00 Nominal PWB Thickness
01 Copper Thickness *
12 PWB Base Material
17 Solder Mask Material
18 Conformal Coat Material

The following is an example of the use of the Fab Parameter:

| | ENTITY CODE | LAYER NO. | VALUE |
|---|---|---|---|
| P FAB | 00 | 00 | 000620 |

* To convert copper thickness to ounces of copper as per MIL-STD-275E, use:

0.0007 inches = 0.5 ounces per square foot
0.0014 inches = 1.0 ounces per square foot
0.0028 inches = 2.0 ounces per square foot

3.2.3 IPC Feature/Location Records

The data set which follows the opening parameter records is made up of Feature/Location Records organized by Data Layer in accordance with IPC-D-350B.

3.2.4 IPC-D-350 NAMING CONVENTION

The IPC file is named "job.ipc". This file name is found in the IPC MIL-STD-1840 header file in "dstdocid:".

| IPC-D-350 PHYSICAL LAYER NUMBER | DESCRIPTION |
|---|---|
| Layer 00 | BOARD OUTLINE, DRILL HOLES |
| Layer 01 | COMPONENT SIDE - CONDUCTIVE |
| Layer 02 | INNER LAYER 1 - CONDUCTIVE |
| Layer 03 | INNER LAYER 2 - CONDUCTIVE |
| Layer 04 | INNER LAYER 3 - CONDUCTIVE |
| Layer 05 | INNER LAYER 4 - CONDUCTIVE |
| Layer 06 | INNER LAYER 5 - CONDUCTIVE |
| Layer 07 | INNER LAYER 6 - CONDUCTIVE |
| Layer 08 | SECONDARY SIDE - CONDUCTIVE |
| Layer 09 | COMPONENT SIDE SILK SCREEN |
| Layer 10 | COMPONENT SIDE SOLDER MASK |
| Layer 11 | SOLDER SIDE SOLDER MASK |
| Layer 12 | SOLDER SIDE SILK SCREEN |

FIGURE 3-3 IPC-D-350 EXAMPLE FOR AN 8-LAYER PWB

## 3.3 Components

A 3D model of a component is captured for its geometry as it is received from its vendor and for its geometry when assembled onto a PWA. These are known as a component's "as-received" and "as-assembled" models respectively. These data include not only the electrical components but all screws, fasteners, glue and any other hardware items found in the assembly parts list. IGES 4.0 is the data specification used to translate these 3D component data from the RPTS to the RAMP PWA factory.

### 3.3.1 Supported IGES Entity

RPTS uses the entities listed in Table 3-4.

Table 3-4
RAMP PWA IGES Entities

| IGES ENTITIES | DESCRIPTION |
|---|---|
| 100 | Circular Arc |
| 102 | Composite Arc |
| 104 FORM | Conic Arcs |
| 0 | General Conic |
| 106 FORM | Data Points |
| 12 | 3D Line Strings |
| 108 | Planes |
| 110 | Line |
| 116 | Point |
| 124 | Transformation Matrix |
| 126 FORM | |
| 0 | Rational B-Spline Curve |
| 1 | Rational B-Spline Curve |
| 2 | Rational B-Spline Curve |
| 3 | Rational B-Spline Curve |
| 4 | Rational B-Spline Curve |
| 5 | Rational B-Spline Curve |
| 128 FORM | |
| 0 | B-spline Surface (Rational B-Spline Surface) |
| 0 | Solid Elliptical Cylinder (Rational B-Spline Surface) |
| 0 | Solid Elliptical Cone (Rational B-Spline Surface) |
| 1 | B-spline Surface (Rational B-Spline Surface) |

Table 3-4 (CONT'D)
RAMP PWA IGES Entities

| | |
|---|---|
| 2 | B-spline Surface (Rational B-Spline Surface) |
| 3 | B-spline Surface (Rational B-Spline Surface) |
| 4 | B-spline Surface (Rational B-Spline Surface) |
| 5 | B-spline Surface (Rational B-Spline Surface) |
| 6 | B-spline Surface (Rational B-Spline Surface) |
| 7 | B-spline Surface (Rational B-Spline Surface) |
| 8 | B-spline Surface (Rational B-Spline Surface) |
| 9 | B-spline Surface (Rational B-Spline Surface) |
| 142 | B-Spline Surface Boundary |
| 144 | B-Spline Surface (Trimmed Surface) |
| 150 | Solid Block |
| 152 | Solid Wedge (Right Angular Wedge) |
| 154 | Solid Cylinder (Right Cylinder) |
| 156 | Solid Cone (Right Circular Cone) |
| 158 | Solid Sphere |
| 160 | Solid Torus |
| 162 | Solid of Revolution |
| 164 | Solid of Projection (Solid of Linear Extrusion |
| 168 | Solid Ellipsoid |
| 180 | Solid Boolean Tree |
| 202 | Dimension Component (Angular Dimension) |
| 212 FORM | |
| 0 | General Note |
| 214 FORM | |
| 1 | Leader (arrow) |
| 216 | Dimension Component (Linear Dimension) |
| 218 | Dimension Component (Ordinate Dimension) |
| 220 | Dimension Component (Point Dimension) |
| 222 | Dimension Component (Radius Dimension) |
| 230 | Sectioned Area |
| 308 | Symbol Header (Sub-figure Definition) |
| 314 | Color Table (Color Definition) |
| 402 FORM | |
| 7 | Unordered Graphic Group with BP |
| 406 FORM | |
| 3 | Level Function |
| 15 | Name Element |
| 18 | Intercharacter Space |
| 408 | Singular Sub-figure Instance (symbol) |
| 410 | View (Window/View) |

### 3.3.2 As-Received 3D Component Data

The as-received component data consists of stylized representation of the component 3D geometry using maximum tolerance values. The following paragraphs describe the contents of the as-received component data.

#### 3.3.2.1 Form Factor Set

The form factor set is the set of references based on the military specifications and is used to identify a component's shape or type of package. The component geometric data is included with the component's form factor. Form Factor is a group of physical attributes which describe the component shape and package type. The form factor consists of the basic component specification number, component specification slash or dash number if needed, the component package style/type number, and the component package case number. The following is a list of data types that constitutes the RAMP form factor set:

| | |
|---|---|
| SPEC | : {SPECIFICATION} |
| SNUM | : { / (SLASH)NUMBER} |
| DNUM | : { - (DASH)NUMBER} |
| STYLE/TYPE | : {STYLE} |
| CASE | : {CASE} |

The form factor information is found in the header file for the component's as-received model. This is formally described in Appendix I.

#### 3.3.2.2 Other Parts List Information

The Other Component Parts List information is defined using the following list of component attributes:

| | |
|---|---|
| CLASS | : {COMPONENT CLASSIFICATION} |
| SUB | : {COMPONENT SUBCLASSIFICATION} |
| PKG | : {COMPONENT PACKAGE} |
| EIA_JDC | : {EIA/JEDEC FORM FACTOR} |
| CAGE | : {CAGE/FSCM NUMBER} |
| ITEM | : {ITEM NUMBER} |
| RDES | : {REFERENCE DESIGNATOR} |
| PN | : {PART NUMBER} |
| LEAD_MAT | : {LEAD MATERIAL COMPOSITION} |
| LEAD_PLT | : {LEAD PLATING MATERIAL COMPOSITION} |

SOLDERABILITY: {COMPONENT SOLDERABILITY}

QNTY: : {QUANTITY OF EACH ITEM PER INSTANCE}

The other part list information is found in the header file for the component's as-received model. This is formally described in Appendix I.

3.3.2.3 Component Dimensional Attributes

The component dimensional data from the component specification documents provide the required data to determine actual component size. The following data types and their definitions are the geometric attributes for a component:

MAX_BODY_DIA : {BODY MAXIMUM DIAMETER}
NOM_BODY_DIA : {BODY NOMINAL DIAMETER}
MIN_BODY_DIA : {BODY MINIMUM DIAMETER}
MAX_BODY_LEN : {BODY MAXIMUM LENGTH}
NOM_BODY_LEN : {BODY NOMINAL LENGTH}
MIN_BODY_LEN : {BODY MINIMUM LENGTH}
MAX_BODY_WDT : {BODY MAXIMUM WIDTH}
NOM_BODY_WDT : {BODY NOMINAL WIDTH}
MIN_BODY_WDT : {BODY MINIMUM WIDTH}
MAX_BODY_HGT : {BODY MAXIMUM HEIGHT}
NOM_BODY_HGT : {BODY NOMINAL HEIGHT}
MIN_BODY_HGT : {BODY MINIMUM HEIGHT}
MAX_LEAD_DIA : {LEAD MAXIMUM DIAMETER}
NOM_LEAD_DIA : {LEAD NOMINAL DIAMETER}
MIN_LEAD_DIA : {LEAD MINIMUM DIAMETER}
MAX_LEAD_LEN : {LEAD MAXIMUM LENGTH}
NOM_LEAD_LEN : {LEAD NOMINAL LENGTH}
MIN_LEAD_LEN : {LEAD MINIMUM LENGTH}
MAX_LEAD_WDT : {LEAD MAXIMUM WIDTH}
NOM_LEAD_WDT : {LEAD NOMINAL WIDTH}
MIN_LEAD_WDT : {LEAD MINIMUM WIDTH}
MAX_LEAD_THK : {LEAD MAXIMUM THICKNESS}
NOM_LEAD_THK : {LEAD NOMINAL THICKNESS}
MIN_LEAD_THK : {LEAD MINIMUM THICKNESS}

The component dimensional attributes information is found in the header file for the component's as-received model. This is formally described in Appendix I.

3.3.2.4 As-Received Components Translated Into IGES

Each component part or item in the PWA is captured mechanically in its as-received geometry. The information captured for each component is translated to IGES making a separate IGES file for each component which allows the factory to review each component in its as-received geometric configuration.

3.3.2.5 As-Received Component IGES File Naming

Three IGES files are required for each As-Received component item on the BOM, one file using solid, one file using surface, and one file using wireframe IGES entities. As-Received component models in separate IGES files are named with "r" for As-Received components, followed by the component item number then "s" for IGES translation using solid entities, "u" for IGES translation using surface entities, "w" for IGES translation using wireframe entities, and with "-igs" extension for IGES. These file names are found in the IGES file 1840 header for each model in: "dstdocid:".

As-Received Component IGES with Solid Entities

r1s-igs = As received component BOM item 1 solid IGES file
r2s-igs = " 2
r3s-igs = " 3
...
rNs-igs with N equal to the last component item number on the BOM and gaps in numerical sequence are allowed.

As-Received Component IGES with Surface Entities

r1u-igs = As received component BOM item 1 surface IGES file
r2u-igs = " 2
r3u-igs = " 3
...
rNu-igs with N equal to the last component item number on the BOM and gaps in numerical sequence are allowed.

As-Received Component IGES with Wireframe Entities

| | | | |
|---|---|---|---|
| r1w-igs | = As received component BOM item 1 wireframe IGES file | | |
| r2w-igs | = | " | 2 |
| r3w-igs | = | " | 3 |
| ... | | | |
| rNw-igs | with N equal to the last component item number on the BOM and gaps in numerical sequence are allowed. | | |

3.3.3 As-Assembled 3D Component

The as-assembled 3D component is a geometric stylized representation of an item as it appears when inserted in the 3D model of the PWA. The 3D as-assembled component model is sent for each instance of the item on the PWA.

An as-assembled 3D component appears as a sub-figure (entity type 408: IGES-SUBFIGURE-INSTANCE) in the IGES translation of the fully developed 3D model of the PWA. There is an IGES entity type 408 for each instance of a item used.

3.3.3.1 Reference Designator

The Reference Designator is the unique identifier for each instance of an item used in a PWA.

RDES = { REFERENCE DESIGNATOR }

Where RDES is the property nomenclature and {REFERENCE DESIGNATOR } is the value of the property.

For 3D components, the value of the property (RDES) is used as the sub-figure name in the IGES translation of the assembly.

3.3.3.2 Pin Numbers

Pin numbers are unique identifiers for each pin of a component.

The pin numbers for 3D components correspond to the pin numbers of components in the 2D assembly. Pin numbers are inserted in the 3D model of the component as text. The location (origin) of the pin number text is coincident with X,Y hole locations as derived from the 2D assembly.

The pin number text is translated in IGES as part of the 3D sub-figure representing a component and is placed on the layer designated as component lead (see Table 3-5 IGES Layering Convention).

3.3.3.3 Component Bodies

The component body is that part of the component that encapsulates the material that performs the required electrical function. The component's leads attach to the component's body. If the component's body also serves as an electrical lead then it is classified as a body.

The geometry generated for the 3D component body is the geometry necessary to create a stylized model. The dimensions of this model are given at their maximum tolerance limits.

The geometry for the component body is in IGES as part of the component sub-figure. See Table 3-5.

3.3.3.4 Component Leads

The component lead is that part of the component that forms an electrical connection with other components.

The geometry generated for the 3D component lead includes the nominal center to center lead spacing and other geometry that is necessary to create a stylized model of the component lead.

The geometry for the component lead is translated into IGES as part of the component sub-figure. See TABLE 3-5.

3.3.3.5 Orientation Vector

The orientation vector is a line segment placed in the body of a 3D component model with its origin at the component centroid. This vector is used to determine the orientation of the component when the component is placed in the 3D assembly model.

The orientation vector is in IGES as part of the component sub-figure is found on the orientation vector layer. See Table 3.5.

3.3.3.6 Centroid

The centroid is a point in the body of a 3D component model located at the center of mass assuming an uniform mass distribution within the solid model of the component body.

The centroid is found in IGES as part of the component sub-figure and is inserted in the model on the layer specified for Orientation Vector. See Table 3.5.

## 3.4 3D Assembly

The 3D Assembly is the 3D model of the PWA with all the 3D models of the "As Assembled" components inserted in their correct locations. Figure 3-4, IGES Assembly Data, illustrates the type of assembly data carried in IGES.

### 3.4.1 Maximum Assembly Envelope

The maximum assembly envelope is the maximum extent of component heights after assembly of the PWA.

The 3D version of the maximum assembly envelope is represented as a surface of zero thickness with planes that are coincident with the maximum outside envelope of the PWA.

The surface representing the maximum assembly envelope is in IGES as part of the 3D assembly model on the layer specified for the maximum assembly envelope. See Table 3-5.

### 3.4.2 Conformal Coat Mask

The conformal coat mask is a protective coating that conforms to the outside of a PWA except in places where the coating would interfere with the operation of the PWA.

The 3D version of the conformal coat mask is represented as a surface with a thickness defined for conformal coating in the TDP with planes that are coincident with the maximum outside envelope of the PWA as defined by the TDP.

The surface representing the conformal coat mask is found in IGES as part of the 3D assembly model on the layer specified for the conformal coat mask. See Table 3-5.

### 3.4.3 Ink

Ink is used to indicate special markings that must be applied to the PWA.

The 3D version of the ink is placed as text in the 3D assembly model on the areas that reflect the placement of ink text. The ink text is translated in IGES as part of the 3D assembly model on the layer specified for ink. See Table 3-5.

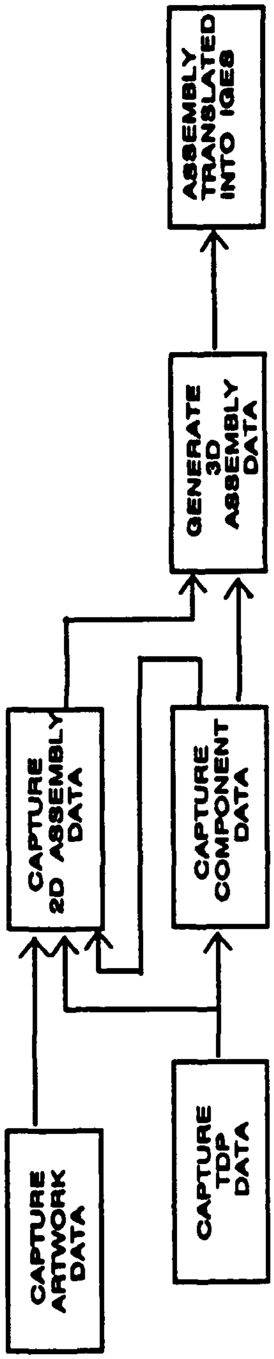


FIGURE 3-4 IGES ASSEMBLY DATA

3.4.4 Glue

Glue is an adhesive substance used to hold components together. Glue is represented in the 3D assembly as a surface with a thickness that reflects the maximum thickness allowed for glue as specified by the TDP on the areas shown in the TDP where glue is to be applied.

The surface representing the glue is translated as part of the 3D assembly model on the layer specified for glue. See Table 3-5.

3.4.5 Special Assembly

A component that fails any of the following rules is placed on one of the Special Assembly layers (see Table 3-5).

1. The component attaches to the PWB only by soldering its leads.
2. The Orientation Vector is parallel to the PWB orientation vector.
3. The component has no intersecting or overlapping 2D projections with another component as viewed from the component side(s) of the PWA.
4. There are no specific restrictions to the wave/reflow soldering of the component.
5. The component does not have Special TDP Assembly instructions.

Any component failing the above rules has its sub-figure segregated by layer as a special assembly sub-figure. This sub-figure is found in IGES as part of the 3D assembly model on the layer specified for special assemblies. See Table 3-5.

3.4.6 ASSEMBLY DATA LIST

The assembly Data List provides a list of drawing numbers and their type classification of the TDP drawings that comprise the PWA. This Data List is found in the IGES assembly (see Table 3-5). The formal syntax is given in Appendix I. If the specification is not available then the description = "NONE". The following is a list of the document types carried in the Data List:

| SPECIFICATION TYPE | SPECIFICATION DESCRIPTION |
|---|---|
| ASSEM | ASSEMBLY SPECIFICATIONS |
| PWBSB | PWB SPECIFICATIONS |
| PROSP | PROCESS SPECIFICATIONS |
| PROG | COMPUTER SPECIFICATIONS |
| SCHEM | SCHEMATIC SPECIFICATIONS |
| TSTSP | TEST SPECIFICATIONS |
| CMPSP | COMPONENT SPECIFICATIONS |
| NEXAS | NEXT ASSEMBLY |
| USEON | USED ON |

### 3.4.7 IGES Layering Convention

The RAMP PWA IGES layering convention is used to identify component and assembly information. This layering convention is given in Table 3-5.

TABLE 3-5
IGES LAYERING CONVENTION

Component Subfigure Layers:

LAYER 00 Component Body
LAYER 01 Component Leads
LAYER 02 Component Orientation Vector/Centroid
LAYER 03 Component Pin Text
LAYER 04 Future Expansion

TABLE 3-5 (CONT'D)
IGES LAYERING CONVENTION

Assembly Layers:

LAYER 00 BATTE
LAYER 05 CAP
LAYER 10 CHEM
LAYER 15 CON
LAYER 20 CORE
LAYER 25 HDWR
LAYER 30 IND
LAYER 35 LAMP
LAYER 40 RES
LAYER 45 ROTMA
LAYER 50 SEMI
LAYER 55 SWTCH
LAYER 60 TRADU
LAYER 65 UCKT
LAYER 70 XFMR
LAYER 75 SPECIAL ASSEMBLY BATTE
LAYER 79 SPECIAL ASSEMBLY BATTE INSTRUCTIONS
LAYER 80 SPECIAL ASSEMBLY CAP
LAYER 84 SPECIAL ASSEMBLY CAP INSTRUCTIONS
LAYER 85 SPECIAL ASSEMBLY CHEM
LAYER 89 SPECIAL ASSEMBLY CHEM INSTRUCTIONS
LAYER 90 SPECIAL ASSEMBLY CON
LAYER 94 SPECIAL ASSEMBLY CON INSTRUCTIONS
LAYER 95 SPECIAL ASSEMBLY CORE
LAYER 99 SPECIAL ASSEMBLY CORE INSTRUCTIONS
LAYER 100 SPECIAL ASSEMBLY HDWR
LAYER 104 SPECIAL ASSEMBLY HDWR INSTRUCTIONS
LAYER 105 SPECIAL ASSEMBLY IND
LAYER 109 SPECIAL ASSEMBLY IND INSTRUCTIONS
LAYER 110 SPECIAL ASSEMBLY LAMP
LAYER 114 SPECIAL ASSEMBLY LAMP INSTRUCTIONS
LAYER 115 SPECIAL ASSEMBLY RES
LAYER 119 SPECIAL ASSEMBLY RES INSTRUCTIONS
LAYER 120 SPECIAL ASSEMBLY ROTMA
LAYER 124 SPECIAL ASSEMBLY ROTMA INSTRUCTIONS
LAYER 125 SPECIAL ASSEMBLY SEMI
LAYER 129 SPECIAL ASSEMBLY SEMI INSTRUCTIONS
LAYER 130 SPECIAL ASSEMBLY SWTCH
LAYER 134 SPECIAL ASSEMBLY SWTCH INSTRUCTIONS
LAYER 135 SPECIAL ASSEMBLY TRADU

TABLE 3-5 (CONT'D)
IGES LAYERING CONVENTION

| |
|---|
| LAYER 139 SPECIAL ASSEMBLY TRADU INSTRUCTIONS |
| LAYER 140 SPECIAL ASSEMBLY UCKT |
| LAYER 144 SPECIAL ASSEMBLY UCKT INSTRUCTIONS |
| LAYER 145 SPECIAL ASSEMBLY XMFR |
| LAYER 149 SPECIAL ASSEMBLY XMFR INSTRUCTIONS |
| LAYER 150 SPECIAL GENERAL INSTRUCTIONS |
| LAYER 155 MAXIMUM ASSEMBLY ENVELOPE |
| LAYER 160 CONFORMAL COAT MASK |
| LAYER 165 ASSEMBLY INKING OR MARKING |
| LAYER 170 ASSEMBLY DATA LIST |
| LAYER 180 PWB |

### 3.4.8 Special Instructions

Special instructions are notes from the TDP that require human interpretation. Special instructions are found in the IGES as part of the 3D assembly model on a special assembly instructions layer for each component class. See TABLE 3-5.

### 3.4.9 3D Assembly Solid Model

Assembly data are found in an IGES file using solid IGES entities. The file naming convention identifies the IGES file as the solid assembly. The naming convention for 3D solid assembly IGES file is:

jobs-igs

This file name is found in the IGES 1840 header associated with this solid assembly file in "dstdocid:"

### 3.4.10 3D Assembly Surface Model

Assembly data are found in an IGES file using surface IGES entities. The file naming convention identifies the IGES file as the surface assembly. The naming convention for the 3D surface assembly IGES file is:

jobu-igs

This file name is found in the IGES 1840 header associated with this solid assembly file in "dstdocid:"

### 3.4.11 3D Assembly Wireframe Model

Assembly data are found in an IGES file using wireframe IGES entities. The file naming convention identifies the IGES file as the wireframe assembly. The naming convention for the 3D wireframe assembly IGES file is:

jobw-igs

This file name is found in the IGES 1840 header associated with this solid assembly file in "dstdocid:"

## 3.5 TDP Raster

The entire TDP is included in the product data description in raster data format. Raster data are in accordance with MIL-STD-1840 for type I (untiled) as defined in MIL-R-28002 (CCITT G4). Raster image density is 200 Dots Per Inch (DPI) for all drawing sizes. Figure 3-5 "CCITT G4 Raster Data" illustrates the type of raster data carried by CCITT G4.

### 3.5.1 Raster File Naming

The raster files are named using the drawing type and document number. The document page number is added after a dash. The file name is ended with ".RAS" extension. The document file name is inserted in the 1840 header of the raster file in the destination document ID record "dstdocid:".

For example:

TYPE, DOCUMENT NUMBER-p.RAS

74E2E356-12.RAS

SP82N5200-1.RAS

82N5200-42.RAS

82N5200-3.RAS

The document type is derived from columns 1 and 2 of the aperture card punch code. Document number is derived from columns 3 through 17 and the sheet number is derived from columns 39 through 41. If an * (asterisk) appears in column 41, then card number appears in columns 55 through 58. Unpunched columns are not used.

3.5.2 1840 Header Definition

The 1840 file header records are formatted as specified by MIL-STD-1840 for type I raster binary data.

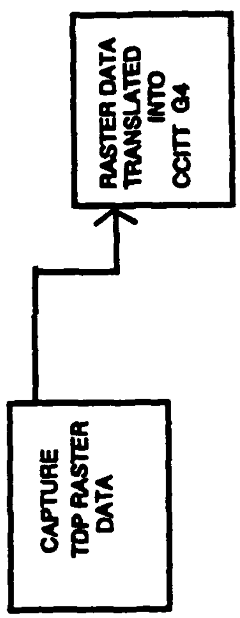


**FIGURE 3-5 CCITT G4 TDP RASTER DATA**

## 3.6 CALS File Naming Convention

File naming conventions are in accordance with CALS MIL-STD-18.. Automated Interchange of Technical Information and RAMP PWA data conventions. M.. STD-1840 requires, for file transfer, one declaration file per TDP.

The naming convention requires that the declaration file be named D001, D002, D003, through DNNN with the data files being named D001X001, D001X002, through DNNNXNNN as shown in Figure 3-6. X, the fifth character in the data file, indicates the type of file Q for IGES, E for EDIF, I for IPC-D-350, R for RASTER, and T for TEXTUAL files.

### 3.6.1 ISF File Naming

The ISF files produced by the RPTS PWA are named to MIL-STD-1840 names as illustrated here:

| 1840 NAME | DESCRIPTION |
|---|---|
| D001 = | DOCUMENT FILE Declaration |
| D001R001 = | TDP RASTERIZED |
| D001T001 = | TEXTUAL FILE |
| D001Q001 = | IGES SOLIDS ASSEMBLY MODEL DATA FILE |
| D001Q002 = | IGES SURFACES ASSEMBLY MODEL DATA FILE |
| D001Q003 = | IGES WIREFRAME ASSEMBLY MODEL DATA FILE |
| D001Q004 = | IGES SOLIDS AS RECEIVED COMPONENT MODEL DATA FILE |
| D001Q00N = | etc. thru to the last solids component model IGES file. |
| D001Q00(N+1) = | IGES SURFACE AS RECEIVED COMPONENT MODEL DATA FILE. |
| D001Q00X = | etc. thru to the last surface component model IGES file. |
| D001Q00(X+1) = | IGES WIREFRAME AS RECEIVED COMPONENT MODEL DATA FILE. |
| D001E001 = | EDIF SCHEMATIC DATA FILE = RAMP PWA job.edf |
| D001I001 = | IPC LAYOUT DATA FILE = RAMP PWA job.ipc |

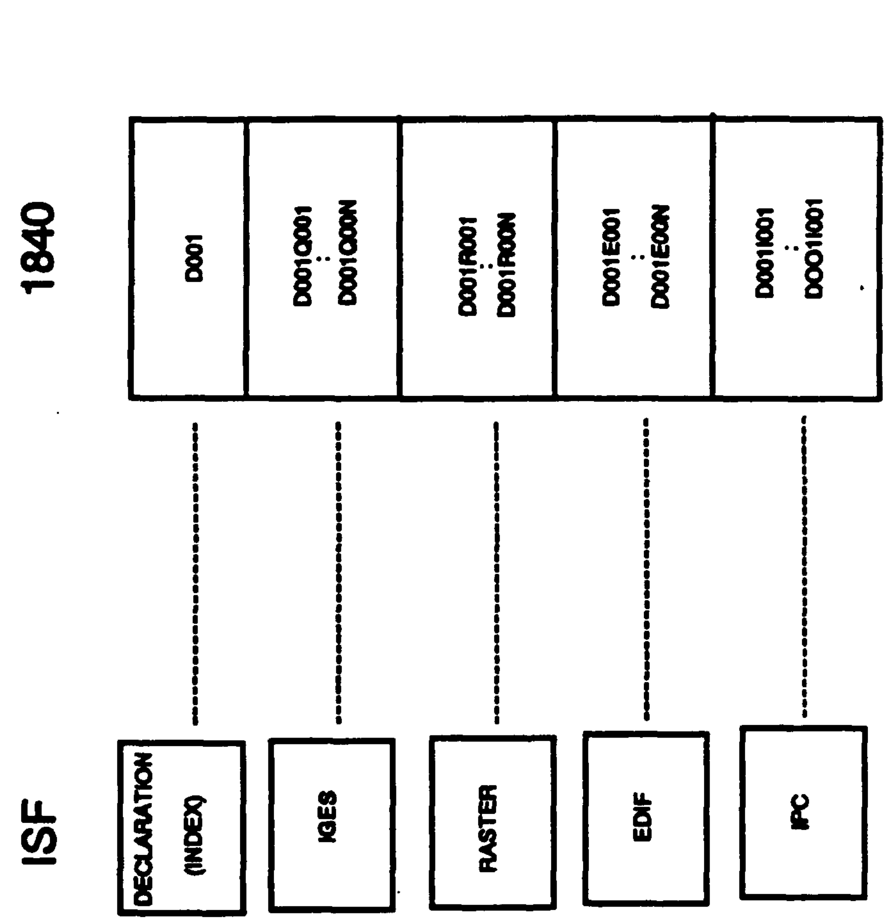


FIGURE 3-6 MIL-STD-1840 FILE NAMING

### 3.6.2 DPD Release Level

The change level record 4 (chglvl:) in the declaration file of the DPD contains the change level, release status, and release date of the DPD. The change level will have an entry of ORIGINAL for the first release and letters according to DOD-STD-100C for subsequent releases. Letter changes will occur only on VALIDATED DPDs. VERIFIED DPDs will hold the next change letter in the sequence since the last VALIDATED DPD was issued. A DPD undergoing a change may have several VERIFIED releases until it is VALIDATED. Only its release date changes from release to release.

For example suppose the last release level was:

chglvl: B,VALIDATED,19911108

then the next file from the RPTS PWA on the next change request will be:

chglvl: C,VERIFIED,19920225

The next DPD file which reflects a corrected to the change will take a release level:

chglvl: C,VERIFIED,19920312

Then, after the file has been validated by a quality assurance activity its release level changes to:

chglvl: C,VALIDATED,19920305

### 3.6.3 Declaration File

The declaration file provides information about the identification, source, destination, classification of the document, and gives a count of the files in the set of files that make up the complete document. The required format for the entry of data in 1840 headers is in APPENDIX I.

### 3.6.4 File Header

Each of the files included in an ISF set has a header. The header is in accordance with MIL-STD-1840. The declaration and header has the following information in sequence (See Table 3-6 and 3-7):

Table 3-6
MIL-STD-1840 Declaration

Declaration FILE D001

srcsys: RPTS, 5300 International Blvd., N. Charleston, SC 29418
srcdocid: NONE
srcrelid: NONE
chglvl: ORIGINAL,VERIFIED,19920123
dteisu: 19870721
dstsys: RPWA, 5300 International Blvd., N. Charleston, SC 29418
dstdocid: 12051, 74E2N356, E
dstrelid: NONE
dtetrn: 19910405
dlvacc: CDRL item 1 of Contract 74529044334 , Due 19920721
filcnt: Q37, I1, E1
ttlcls: Unclass
doccls: Unclass
doctyp: Printed Wiring Assembly
docttl: Fault Reset Control

Table 3-7
MIL-STD-1840 Headers

| | RASTER HEADER |
|---|---|
| srcdocid | Source System Document Identifier |
| dstdocid | Destination System Document Identifier |
| txtfilid | Text File Identifier |
| figid | Figure Identifier |
| srcgph | Source System Graphics Filename |
| doccls | Data File Security Label |
| rtype | Raster Data MIL-R-28002 Type 1 or 2 |
| rorient | Raster Image Orientation |
| rpelcnt | Raster Image Picture Element Count |
| rdensity | Raster Image Density |
| notes | |

Table 3-7 (CONT'D)
MIL-STD-1840 Header

Raster Header file example:

```
srcdocid: HOLLERITH CODE
dstdocid: SH74E2N356-1.ras
txtfilid: NONE
figid: NONE
srcgph: NONE
doccls: unclass
rtype: 1
rorient: 090,270
rpelcnt: 005120,005120
rdensity: 0400
notes:
```

IGES, EDIF, AND IPC HEADER

| | |
|---|---|
| srcdocid | Source System Document Identifier |
| dstdocid | Destination System Document Identifier |
| txtfilid | Text File Identifier |
| figid | Figure Identifier |
| srcgph | Source System Graphics Filename |
| doccls | Data File Security Label |
| notes | |

IGES Header file example:

```
srcdocid: NONE
dstdocid: r10w-igs
txtfilid: NONE
figid: NONE
srcgph: NONE
doccls: unclass
notes:
```

Table 3-7 (CONT'D)
MIL-STD-1840 Header

EDIF Header file example:

```
srcdocid: NONE
dstdocid: job.edf
txtfilid: NONE
figid: NONE
srcgph: NONE
doccls: unclass
notes:
```

IPC Header file example:

```
srcdocid: NONE
dstdocid: job.ipc
txtfilid: NONE
figid: NONE
srcgph: NONE
doccls: unclass
notes:
```

### 3.6.5 File Name Summary

The file name summary provides quick reference of file type, file specification, MIL-STD-1840 name, and a generic CAD name. See Table 3-8.

TABLE 3-8
FILE NAME SUMMARY

| FILE TYPE | | SPECIFICATION | 1840 NAME |
|---|---|---|---|
| 2DECLARATION | = | MIL-STD 1840 | = D001 |
| RASTER | = | MIL-STD 1840 | = D001R001 ... |
| TEXTUAL | = | MIL-STD 1840 | = D001T001 |
| SCHEMATIC | = | EDIF | = D001E001 |
| ASSEMBLY 3D WIREFRAME | = | IGES | = D001Q001 |
| ASSEMBLY 3D SURFACE | = | IGES | = D001Q002 |
| ASSEMBLY 3D SOLID | = | IGES | = D001Q003 |
| COMPONENT | = | IGES | = D002Q002 ... |
| 2D LAYOUT | = | IPC | = D001I001 |

## 3.6.6 Physical Media for File Transfer

The RPTS PWA supports 1/4 cartridge tape as a physical file transfer media.

# APPENDIX I

# 10.0 PDD FORMAL SYNTAX

## 10.1 ATTRIBUTE FORMAL SYNTAX

The formal syntax definition (FSD) for adding RAMP required attributes to the component descriptions. The syntax used is derived from Backus-Naur Format (BNF).

Operator definitions.

| OPERATOR | MEANING |
|---|---|
| : | is defined as |
| \| | separation between options |
| [] | optionality brackets |
| ; | end of a rule in the FSD |
| ! | introduction of a comment |
| {} | rule grouping |
| , | separates required operation |

## 10.2 COMPONENT ATTRIBUTES

### 10.2.1 EDIF SCHEMATIC COMPONENT ATTRIBUTES

EDIF component attributes are those component attributes that are defined as properties of a schematic component symbol.

```
comp-model: { comp-spec
              comp-class
              comp-prop
              comp-geom };

comp-class: { "CLASS" class-name };

class-name: { "BATTE"
               batte-sub-name
               pkg-name |
               "CAP"
               cap-sub-name
               pkg-name |
              "CHEM"
               chem-sub-name
               pkg-name |
              "CON"
               con-sub-name
               pkg-name |
```

```
                    "CORE"
                     core-sub-name
                     pkg-name |
                    "IND"
                     ind-sub-name
                     pkg-name |
                    "LAMP"
                     lamp-sub-name
                     pkg-name |
                    "HDWR"
                     hdwr-sub-name
                     pkg-name |
                    "IND"
                     ind-sub-name
                     pkg-name |
                    "PWB"
                     pwb-sub-name
                     pwb-pkg-name
                    "RES"
                     res-sub-name
                     pkg-name |
                    "ROTMA"
                     rotmac-sub-name
                     pkg-name |
                    "SEMI"
                     semi-sub-name
                     pkg-name |
                    "SWTCH"
                     swtch-sub-name
                     pkg-name |
                    "TRADU"
                     tradu-sub-name
                     pkg-name |
                    "UCKT"
                     uckt-sub-name
                     pkg-name |
                    "XFMR"
                     xfmr-sub-name
                     pkg-name };

batte-sub-name: { "NONR" | "RECH" };

cap-sub-name: { "FIXED" | "VAR" };

chem-sub-name: { "BAGT" | "CAGT" | "CLAGT | "IAGT" | "MAGT" | "TAGT" };

con-sub-name: { "ANTEN" | "BUSBR" | "EDGE" | "FUSE" | "JUM" | "PLUG" |  "RECPT"
              | "TERM" | "TERMT" | "TERMP" | "TETBK" };
```

```
core-sub-name: { "FEBED" };

ind-sub-name:  { "FIXED" | "VAR" };

lamp-sub-name:  { "FLUOR" | "GLOW" | "INCAN" | "BALLA" };

hdwr-sub-name: { "BOLT" | "BRACK" | "BRVT" | "CLAMP" | "CRVT" | "CLIP" |"EJECT"
               | "EYELE" | "FRAME" | "FWSHR" | "LWSHR" | "HANDL" | "INSUL" |
               "NUT" | "PIN" | "RRING" | "TIES" | "TRVT" | "SCREW" | "SHIEL" |
               "SLEEV" | "SPACE" | "SPREA" | "SPRIN"  "};

ind-sub-name: { "FIXED" | "VAR" };

pwb-sub-name: { "FLEX" | "HYB" | "MOLD" | "RFLEX" |
                "RIGID" };

res-sub-name: { "FIXED" | "VAR" };

rotma-sub-name: { "ACMAC" | "DCMAC" | "SYNCH" };

semi-sub-name: { "DIODE" | "SCR" | "TRANS" };

swtch-sub-name: { "SWTCH" | "RELAY" };

tradu-sub-name: { "BELL" | "HALL" | "MIC" | "SPK" | "XTL" };

uckt-sub-name: { "DIG" | "HYB" | "LIN" | "MIXED" };

xfmr-sub-name: { "POWER" | "SIGNL" };

pwb-pkg-name:  { "TYPE1" | "TYPE2" | "TYPE3" | "TYPE4" | "TYPE5" | "TYPE6" };

pkg-name:      { "AXIAL" | "CAN" | "CHIP" | "RDL" | "SM" | "SM" | "PLCLP" |
               "MTCLP" | "PCLIP" | "HANDL" | "LOBAR" | "PUBAR" | "DISK" |
               "PAD" | "PLATE" | "WASHR" | "ALIGN" | "SPRIN" | "PTIES" |
               "STIES" | "TUBE" | "HTSRK" | "COMPS" | "TENSP" | "THERS" };

attribute_name: "PTYPE" ptype-name
                "RDES" rdes-name
               ["CHTYP_VAL" chtyp_val-name]
               ["CHTYP_PTL" chtyp_ptl-name]
               ["CHTYP_NTL" chtyp-ntl-name]
               "GPN" gpn-name
               ["CHTYP_LT" chtyp_lt-name]
               "AP_SPEC" ap_spec-name
               "PN" pn-name
               "ITEM" item-name
               ["CAGE" cage-name]
```

["MAX_WK_VOLT" max_wk_volt-name]
["COMP_PWR" comp_pwr-name]
["SOLDERABILITY" solderability-name]
["LEAD_MAT" lead_mat-name]
["LEAD_PLT" lead_plt-name]
["REV" rev-name]

### 10.2.2 3D COMPONENT ATTRIBUTES IN IGES HEADER

IGES 3D component attributes are those component attributes that are defined as properties of a 3D component.

"SPEC" spec-name
["SNUM" snum-name]
["DNUM" dnum-name]
["STYLE" style-name]
["CASE" case-name]
["AP_SPEC" ap_spec-name]
["EIA_JDC" eia_jdc-name]
"CLASS" class-name
"SUB" sub-name
"PKG" pkg-name
["QNTY" qnty-name]
["MAX_WK_VOLT" max_wk_volt-name]
["COMP_PWR" comp_pwr-name]
["SOLDERABILITY" solderability-name]
["LEAD_MAT" lead_mat-name]
["LEAD_PLT" lead_plt-name]
"MAX_BODY_DIA" max_body_dia-number
"NOM_BODY_DIA" nom_body_dia-number
"MIN_BODY_DIA" min_body_dia-number
"MAX_BODY_LEN" max_body_len-number
"NOM_BODY_LEN" nom_body_len-number
"MIN_BODY_LEN" min_body_len-number
"MAX_BODY_WDT" max_body_wdt-number
"NOM_BODY_WDT" nom_body_wdt-number
"MIN_BODY_WDT" min_body_wdt-number
"MAX_BODY_HGT" max_body_hgt-number
"NOM_BODY_HGT" nom_body_hgt-number
"MIN_BODY_HGT" min_body_hgt-number
"MAX_LEAD_DIA" max_lead_dia-number
"NOM_LEAD_DIA" nom_lead_dia-number
"MIN_LEAD_DIA" min_lead_dia-number
"MAX_LEAD_LEN" max_lead_len-number
"NOM_LEAD_LEN" nom_lead_len-number
"MIN_LEAD_LEN" min_lead_len-number
"MAX_LEAD_WDT" max_lead_wdt-number
"NOM_LEAD_WDT" nom_lead_wdt-number
"MIN_LEAD_WDT" min_lead_wdt-number

```
"MAX_LEAD_THK" max_lead_thk-number
"NOM_LEAD_THK" nom_lead_thk-number
"MIN_LEAD_THK" min_lead_thk-number
```

## 10.2.3 COMPONENT ATTRIBUTE DATA FORMAT

```
ptype-name:     { "ANA"  "BIZ" | "CAP" | "CSW"| "CUST" |"ZDI"|  "DAR"
                | "DIO" | "DIPCAP" | "EDG" | "FET" | "FUS" | "HYB" |
                "IND" | "JUM" | "LED" | "LSI" | "MSI" | "OPJ" | "OSW" |
                "PCA" | "PWB" | "PIS" | "POT" | "PWB" | "RCL" | "RCNO"
                | "RCNC" | "RES" | "RHE" | "RP_DB" | "RP_DH" | "RP_DI"
                "RP_DT" | "RP_SB"| "RP_SH" | "RP_SI" | "RP_ST" | "SCR"
                | "SSI" | "TCA" | "TPCP" | "TPCS" | "TRA" | "TRNN" |
                "TRNP" | "UNI" | "VHSIC" | "VLSI" | "XTL" | "ZDI"};

rdes-name:      { any alpha-numeric name not to exceed 8 characters in
                length};

f4-number: { "1" | "1" | "1" | "1" |
             "2" | "2" | "2" | "2" |
             "3" | "3" | "3" | "3" |
             "4" | "4" | "4" | "4" |
             "5" | "5" | "5" | "5" |
             "6" | "6" | "6" | "6" |
             "7" | "7" | "7" | "7" |
             "8" | "8" | "8" | "8" |
             "9" | "9" | "9" | "9" |
             "0" | "0" | "0" | "0" | };

chtyp_val-name: { f7.4 [val-multiplier]};

pos-integer: { "1" | "2" | "3" | ...};

val-multiplier: { "T" | "G" | "M" | "K" | "m" | "u" | "n" | "p" |
                "f"};

chtyp_ntl-name: percent;

chtyp_ptl-name: percent;

percent: { "1" | "1" | "1" | "." | "1" |
           "2" | "2" | "2" | "." | "2" |
           "3" | "3" | "3" | "." | "3" |
           "4" | "4" | "4" | "." | "4" |
           "5" | "5" | "5" | "." | "5" |
           "6" | "6" | "6" | "." | "6" |
```

```
        "7" | "7" | "7" | "." | "7" |
        "8" | "8" | "8" | "." | "8" |
        "9" | "9" | "9" | "." | "9" |
        "0" | "0" | "0" | "." | "0" |  };
```

```
gpn-name: { any alpha-numeric ASCII name not to exceed 15
          characters in length};

chtyp_lt-name: { "ALU" | "ANA" | "CLK" | "CNT" | "COM" |
                 "DMUX" | "DRAM" | "HYB" | "MUX" | "PIO" |
                 "PLD" | "RAM" | "ROM" | "SEQ" | "SRAM" |};

ap_spec-name:  { any alpha-numeric name not to exceed 15 characters in
               length};

pn-name:  { any alpha-numeric name not to exceed 18 characters in
          length};

qnty-name: {  f3-number "IN" | "NS" | "AR" };

item-name: { f4-number };

cage-name: { f5-number };

f5-number: { "1" | "1" | "1" | "1" | "1" |
             "2" | "2" | "2" | "2" | "2" |
             "3" | "3" | "3" | "3" | "3" |
             "4" | "4" | "4" | "4" | "4" |
             "5" | "5" | "5" | "5" | "5" |
             "6" | "6" | "6" | "6" | "6" |
             "7" | "7" | "7" | "7" | "7" |
             "8" | "8" | "8" | "8" | "8" |
             "9" | "9" | "9" | "9" | "9" |
             "0" | "0" | "0" | "0" | "0" |  };

f15-number:
{ "1" | "1" | "1" | "1" | "1" | "1" | "1" | "1" |
  "2" | "2" | "2" | "2" | "2" | "2" | "2" | "2" |
  "3" | "3" | "3" | "3" | "3" | "3" | "3" | "3" |
  "4" | "4" | "4" | "4" | "4" | "4" | "4" | "4" |
  "5" | "5" | "5" | "5" | "5" | "5" | "5" | "5" |
  "6" | "6" | "6" | "6" | "6" | "6" | "6" | "6" |
  "7" | "7" | "7" | "7" | "7" | "7" | "7" | "7" |
  "8" | "8" | "8" | "8" | "8" | "8" | "8" | "8" |
  "9" | "9" | "9" | "9" | "9" | "9" | "9" | "9" |
  "0" | "0" | "0" | "0" | "0" | "0" | "0" | "0" |..5);

max_wk_volt-name : { f7.4-number };
```

```
f7-number:
{ "1" | "1" | "1" | "1" | "1" | "1" | "1" | "1" |
  "2"   "2"   "2"   "2"   "2"   "2"   "2"   "2"
  "3"   "3"   "3"   "3"   "3"   "3"   "3"   "3"
  "4"   "4"   "4"   "4"   "4"   "4"   "4"   "4"
  "5"   "5"   "5"   "5"   "5"   "5"   "5"   "5"
  "6"   "6"   "6"   "6"   "6"   "6"   "6"   "6"
  "7"   "7"   "7"   "7"   "7"   "7"   "7"   "7"
  "8"   "8"   "8"   "8"   "8"   "8"   "8"   "8"
  "9"   "9"   "9"   "9"   "9"   "9"   "9"   "9"
  "0" | "0" | "0" | "0" | "0" | "0" | "0" | "0" |..15};

comp_pwr-name: { f7.4-number };

solderability-name : { "NIL" | "NOWAV" | "NRFLO" | "NWRF" };

lead_mtl-name: { "STL" | "OTH" };

lead_plt-name: { "GLD" | "OTH" };

rev-name: { DOD-STD-100 change letters};

spec-name: { any alpha numeric ASCII name not to exceed 5  characters
        in length};

snum-name: { any numeric ASCII name not to exceed 3 characters in
        length};

dnum-name: { any numeric ASCII name not to exceed 4 characters in l
        length};

style-name: { any alpha numeric ASCII name not to exceed 8  characters
        in length};

case-name: { any alpha numeric ASCII name not to exceed 8 characters in
        length};

eia_jedec-name: { any alpha numeric ASCII name not to exceed 12
            characters in length};

nom_body_dia-number: { f7.4-number };

min_body_dia-number: { f7.4-number };

max_body_len-number: { f7.4-number };

nom_body_len-number: { f7.4-number };

min_body_len-number: { f7.4-number };
```

```
max_body_wdt-number: { f7.4-number };

nom_body_wdt-number: { f7.4-number };

min_body_wdt-number: { f7.4-number };

max_body_hgt-number: { f7.4-number };

nom_body_hgt-number: { f7.4-number };

min_body_hgt-number: { f7.4-number };

max_lead_dia-number: { f7.4-number };

nom_lead_dia-number: { f7.4-number };

min_lead_dia-number: { f7.4-number };

max_lead_len-number: { f7.4-number };

nom_lead_len-number: { f7.4-number };

min_lead_len-number: { f7.4-number };

max_lead_wdt-number: { f7.4-number };

nom_lead_wdt-number: { f7.4-number };

min_lead_wdt-number: { f7.4-number };

max_lead_thk-number: { f7.4-number };

nom_lead_thk-number: { f7.4-number };

min_lead_thk-number: { f7.4-number };

f7.4-number: { "1" | "1" | "1" | "." | "1" | "1" | "1" | "1" |
               "2"   "2"   "2"   "."   "2"   "2"   "2"   "2"
               "3"   "3"   "3"   "."   "3"   "3"   "3"   "3"
               "4"   "4"   "4"   "."   "4"   "4"   "4"   "4"
               "5"   "5"   "5"   "."   "5"   "5"   "5"   "5"
               "6"   "6"   "6"   "."   "6"   "6"   "6"   "6"
               "7"   "7"   "7"   "."   "7"   "7"   "7"   "7"
               "8"   "8"   "8"   "."   "8"   "8"   "8"   "8"
               "9"   "9"   "9"   "."   "9"   "9"   "9"   "9"
               "0"   "0"   "0"   "."   "0"   "0"   "0"   "0"   };
```

## 10.3 ASSEMBLY ATTRIBUTES

```
"IGES_LAYER" iges_layer-name
"SNUM" slash-number
"DNUM" dash-number
"STYLE" style-name
"CASE" case-name
"EIA_JEDEC" eia_jedec-name
"data_list" data_list-name
"data_list_drawing" data_list_drawing-name
```

```
slash-number: { "1" | "1" | "1"
                "2" | "2" | "2"
                "3" | "3" | "3"
                "4" | "4" | "4"
                "5" | "5" | "5"
                "6" | "6" | "6"
                "7" | "7" | "7"
                "8" | "8" | "8"
                "9" | "9" | "9"
                "0" | "0" | "0" |};

f3-number: { "1" | "1" | "1" |
             "2" | "2" | "2" |
             "3" | "3" | "3" |
             "4" | "4" | "4" |
             "5" | "5" | "5" |
             "6" | "6" | "6" |
             "7" | "7" | "7" |
             "8" | "8" | "8" |
             "9" | "9" | "9" |
             "0" | "0" | "0" |};

dash-number: { "1" | "1" | "1" | "1" |
               "2" | "2" | "2" | "2" |
               "3" | "3" | "3" | "3" |
               "4" | "4" | "4" | "4" |
               "5" | "5" | "5" | "5" |
               "6" | "6" | "6" | "6" |
               "7" | "7" | "7" | "7" |
               "8" | "8" | "8" | "8" |
               "9" | "9" | "9" | "9" |
```

```
            "0" | "0" | "0" | "0" |};

style-name: { any alpha numeric ASCII name not to exceed 8  characters
               in length};
case-name: { any alpha numeric ASCII name not to exceed 8   characters
               in length};
eia_jedec-name: { any alpha numeric ASCII name not to exceed 12
                characters in length};
spec_type-name: { "ASSEM", "ARTWK", "SCHEM", "CMPSP", "NEXAS", "USEON"
                   };
data_list_drawing-name: { any alpha numeric ASCII name not to exceed 18
                characters in length};

max_body_dia-number: { f7.4-number };


iges_layer-name: { "00"["BATTE COMPONENTS"] |
                   "05"["CAP COMPONENTS"] |
                   "10"["CHEM COMPONENTS"]|
                   "15"["CON COMPONENTS"] |
                   "20"["CORE COMPONENTS"] |
                   "25"["HDWR COMPONENTS"] |
                   "30"["IND COMPONENTS"] |
                   "35"["LAMP COMPONENTS"] |
                   "40"["RES COMPONENTS"] |
                   "45"["ROTMAC COMPONENTS"] |
                   "50"["SEMI COMPONENTS"] |
                   "55"["SWTCH COMPONENTS"] |
                   "60"["TRADUC COMPONENTS"] |
                   "65"["UCKT COMPONENTS"] |
                   "70"["XFMR COMPONENTS"] |
                   "75"["SPECIAL ASSEMBLY BATTE COMPONENT BODIES"] |
                   "80"["SPECIAL ASSEMBLY CAP COMPONENTS"] |
                   "85"["SPECIAL ASSEMBLY CHEM COMPONENTS"] |
                   "90"["SPECIAL ASSEMBLY CON COMPONENTS"]|
                   "95"["SPECIAL ASSEMBLY CORE COMPONENTS"] |
                   "100"["SPECIAL ASSEMBLY HDWR COMPONENTS"] |
                   "105"["SPECIAL ASSEMBLY IND COMPONENTS"] |
                   "110"["SPECIAL ASSEMBLY LAMP COMPONENTS"] |
                   "115"["SPECIAL ASSEMBLY RES COMPONENTS"] |
                   "120"["SPECIAL ASSEMBLY ROTMAC COMPONENTS"] |
                   "125"["SPECIAL ASSEMBLY SEMI COMPONENTS"] |
                   "130"["SPECIAL ASSEMBLY SWTCH COMPONENTS"] |
                   "135"["SPECIAL ASSEMBLY TRADUC COMPONENTS"] |
                   "140"["SPECIAL ASSEMBLY UCKT COMPONENTS"] |
                   "145"["SPECIAL ASSEMBLY XMFR COMPONENTS"] |
                   "150"["SPECIAL INSTRUCTIONS"] |
                   "155"["MAXIMUM ASSEMBLY ENVELOPE"] |
                   "160"["CONFORMAL COAT MASK"] |
```

```
"165"["ASSEMBLY INKING OR MASKING"] |
"170"["ASSEMBLY DATA LIST"] |
"180"["PWB"] };                                        };
```

## 10.4 CALS ATTRIBUTES

DECLARATION FILE

```
srcsys: { srcsys-name }
srcdocid: { srcdocid-name }
srcrelid: { srcrelid-name }
chglvl: { chglvl-name }
dteisu: { dteisu-date }
dstsys: { dstsys-name }
dstdocid: { cage-name }","{ pn-name }","{ rev-name }
dstrelid: { dstrelid-name }
dtetrn: { dtetrn-date }
dlvacc: { dlvacc-number }
filcnt: { filcnt-number }
ttlcls: { ttlcls-name }
doccls: { doccls-name }
doctyp: { doctyp-name }
docttl: { docttl-name }
```

IGES,EDIF,IPC-D-350 HEADER

```
srcdocid:{ srcdocid-name }
dstdocid: { igesipcedifdstdocid-name }
txtfilid: { txtfilid-name }
figid: { figid-name }
srcgph: { srogph-name }
doccls: { doccls-name }
notes: { notes-name }
```

CCITTG4 HEADER

```
srcdocid: { srcdocid-name }
dstdocid: { ccittg4srcdocid-name }
txtfilid: {txtfilid-name }
figid: { figid-name }
srcgph: { srogph-name }
doccls: { doccls-name }
notes: { notes-name }
```

```
srcsys-name: { any alpha numeric ASCII name not to exceed 48 characters
               in length};
igesipcedifsrcdocid-name: { any alpha/numeric 15 characters};
ccittg4srcdocid-name: { "HOLLERITH CODE" };
HOLLERITH_CODE: { any ASCII character from the aperture card};
srcrelid-name: { "NONE" };
chglvl: { "ORIGINAL" |DOD-STD-100 CHANGE LETTER(S) }","{    "VALIDATED"
        | "VERIFIED" }","{YYYYMMDD};
```

```
dteisu-date : {YYYYMMDD};
dstsys-name: { any alpha numeric ASCII name not to exceed 15
               characters in length};
dstdocid-name: { drawing number comprised any alpha numeric ASCII name
               not to exceed 15 characters in length };
dstrelid-name: { "NONE" };
dtetrn-date: { "NONE" };
dlvacc-number: { any alpha numeric ASCII name not to exceed 48
               characters in length};
filcnt-code: { "Q"pos-integer | "I"pos-integer
               "E"pos-integer | "R"pos-integer
               "T"pos-integer };
pos-integer: { "1" |
               "2" |
               "3" |
               "4" |
               "5" |
               "6" |
               "7" |
               "8" |
               "9" |
               "0" |};
ttlcls-name: { any alpha numeric ASCII name not to exceed 15
               characters in length};
doccls-name: { any alpha numeric ASCII name not to exceed 15
               characters in length};
doctyp-name: { any alpha numeric ASCII name not to exceed 15
               characters in length);
docttl-name: { any alpha numeric ASCII name not to exceed 15
               characters in length);
txtfilid-name:  { "NONE");

figid-name: { "NONE" };

srogph-name: { "NONE" };

doccls-name: { any alpha numeric ASCII name not to exceed 15
               characters in length);
notes-name:   { "any alpha numeric ASCII name representing the
          manufacture of the translatore used", "any alpha numeric
          ASCII name representing the Industry Standard Specification
          version",  "any alpha numeric ASCII name representing the
          manufacture's translator version" };
```

END FORMAL SYNTAX

## APPENDIX II

## 20.0 COMPONENT ORIENTATION VECTOR

### 20.1 ORIENTATION VECTOR

The Component Orientation Vector is provided in the RAMP PWA product data in both the "as-assembled" and "as-received" models of each component of the PWA. This vector can be used to determine the orientation of the component with respect to the PWB as shown in Appendix II, Figure II-1. This vector has its origin as the component's computed center-of-mass and its end point at .1i+.1j+.1k where i,j, and k are unit vectors along the x, y, and z axes respectively. The component "as-received" model is created using the following rules for determining its x,y,z coordinate system:

1) A reference orientation of the component is established which conforms to the most mechanically stable or usual mounting position for that component on an imaginary PWB.
2) The z axis is then established, for the component, at right angles to the imaginary PWB. Positive z values increase in a direction away from the imaginary PWB.
3) The y axis is then established at right angles to the z axis and in the plane of the imaginary PWB and along the longest package dimension (sometimes called the length).
4) The x axis is then established at right angles to both the y and z axes and usually is along the shortest body dimension (sometimes called the width).
5) The center-of-mass for the component's body is computed as is used as the orientation vector's starting point.
6) The vector is then created as follows:
   To the center-of-mass point (Xc,Yc,Zc) add .1 unit in each direction to get the vector's end point (Xc+1,Yc+1,Xc+1). The orientation vector is, therefore, described by:

   $$Vcmp = ((Xc+.1)-Xc)i + ((Yc+.1)-Yc)j + ((Zc+.1)-Zc)k \quad \text{or}$$

   $$Vcmp = .1i + .1j + .1k$$ with respect to the component's center-of-mass.

The following equations can be used to determine the orientation of the component with respect to the PWB.

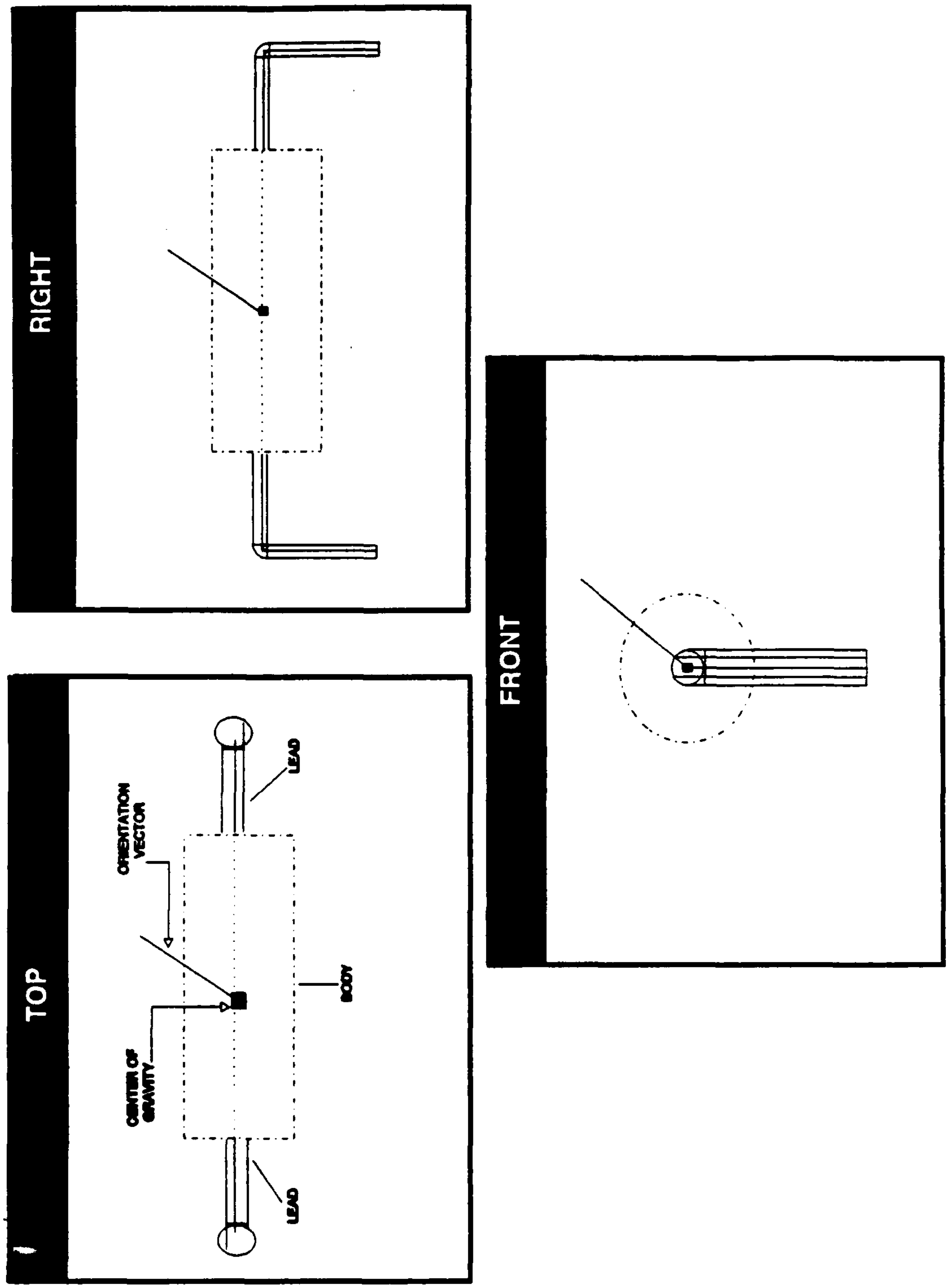


FIGURE 20-1 COMPONENT ORIENTATION VECTOR

When the component is placed on the PWB to form the assembly its center-of-mass takes on a new location (Xp,Yp,Zp) with respect to the PWB's coordinate system and the component's orientation vector takes on a new direction given by:

$Vcmp' = (Xo-Xp)\mathbf{i} + (Yo-Yp)\mathbf{j} + (Zo-Zp)\mathbf{k}$ where Xo,Yo,Zo is the new vector end point with respect to the PWB's origin.

To compute the component orientation the following relationships need to be computed using the PWB orientation vector Vpwb and the component's orientation vector Vcmp':

For rotation about the Z axis in degrees:

for $(Xo-Xp) \geq 0$,

$\theta z = \text{Arc sin} [(10 * (Yo-Yp))/\sqrt{2}] - 45^\circ$

for $(Xo-Xp) < 0$,

$\theta z = 180^\circ - \{ \text{Arc sin} [(10 * (Yo-Yp))/\sqrt{2}] \} - 45^\circ$

For rotation about the X axis in degrees:

for $(Yo-Yp) \geq 0$,

$\theta x = \text{Arc sin} [(10 * (Zo-Zp))/\sqrt{2}] - 45^\circ$

for $(Yo-Yp) < 0$,

$\theta z = 180^\circ - \{ \text{Arc sin} [(10 * (Zo-Zp))/\sqrt{2}] \} - 45^\circ$

For rotation about the Y axis in degrees:

for $(Zo-Zp) \geq 0$,

$\theta y = \text{Arc sin} [(10 * (Xo-Xp))/\sqrt{2}] - 45^\circ$

for $(Zo-Zp) < 0$,

$\theta y = 180^\circ - \{ \text{Arc sin} [(10 * (Xo-Xp))/\sqrt{2}] \} - 45^\circ$

Where a positive rotation is counter clockwise from the component side of the board. $\theta z$ represents the component's rotation in a plane parallel to the PWB surface. $\theta x$ and $\theta y$ are the component's rotation about axes in the PWB's plane.

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# APPENDIX III

## 30.0 COMPONENT CLASS SUB PTYPE PKG REFERENCE

### 30.1 COMPONENT CLASSIFICATION

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| BATTE | NONR | ALKA | AXIAL | ALKALINE NONRECHARGABLE BATTERY |
| | | | CAN | |
| | NONR | CARB | AXIAL | CARBON NONRECHARGABLE BATTERY |
| | | | CAN | |
| | RECH | LDAC | AXIAL | LEAD ACID RECHARGEABLE BATTERY |
| | | | CAN | |
| | RECH | NICAD | AXIAL | NICKEL CADMIUM RECHARGEABLE BATTERY |
| | | | CAN | |
| CAP | FIXED | CAP | AXIAL | CAPACITOR |
| | | | CHIP | |
| | | | RDL | |
| | | DIPCAP | DIP | CAPACITOR |
| | | PCA | AXIAL | POLARIZED CAPACITOR |
| | | | CHIP | |
| | | | RDL | |
| | | TCA | AXIAL | TANTALUM CAPACITOR |
| | | | CHIP | |
| | | | RDL | |
| | VAR | CAP | RDL | CAPACITOR |
| CHEM | BAGT | BAGT | | BONDING AGENT |
| | CAGT | CAGT | | COMPOUND AGENT |
| | CLAGT | CLAGT | | CLEANING AGENT |
| | IAGT | IAGT | | INSULATING AGENT |
| | MAGT | MAGT | | MARKING AGENT |
| | TAGT | TAGT | | THERMAL AGENT |
| CON | ANTEN | DIPOL | | ANTENNA |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| | | MONPO | | |
| | BUSBR | BUSBR | | BUSBAR |
| | EDGE | EDGE | RDL | EDGE CONNECTOR |
| | | | SM | |
| | FUSE | FUSE | RDL | FUSE |
| | JUM | JUM | | JUMPER |
| | | OPJ | | OPEN JUMPER |
| | | COAX | | COAXIAL CABLE |
| | | WAVG | | WAVEGUIDE |
| | PLUG | TPCP | RDL | TWO PART CONNECTOR PIN |
| | | | SM | |
| | RECPT | TPCS | RDL | TWO PART CONNECTOR SOCKET |
| | | | SM | |
| | TERM | PIS | RDL | PACKAGING/INTERCONNECTING STRUCTURE |
| | | | SM | |
| | TERMT | TERMT | RDL | TERMINAL BOARD STRIP |
| | | | SM | |
| | TERMP | TERMP | RDL | TERMINAL STRAP |
| | | | SM | |
| | TESTB | TESTB | RDL | TEST BLOCK |
| | | | SM | |
| CORE | FEBED | FEBED | | FERRITE BEAD CORE |
| IND | FIXED | IND | AXIAL | INDUCTOR |
| | | | CHIP | |
| | | | RADIAL | |
| | VAR | IND | RDL | INDUCTOR |
| LAMP | FLUOR | FLOUR | | FLUORESCENT LAMP |
| | GLOW | GLOW | | GLOW COLD CATHODE LAMP |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| | INCAN | INCAN | | INCANDESCENT |
| | BALLA | BALLA | | BALLAST LAMP |
| HDWR | BOLT | BOLT | | BOLT |
| | BRACK | BRACK | | BRACKET |
| | BRVT | BRVT | | BLIND RIVET |
| | CLAMP | CLAMP | MTCLP | METAL CLAMP |
| | | | PLCLP | PLASTIC CLAMP |
| | CRVT | CRVT | | COUNTERSINK RIVET |
| | CLIP | CLIP | MCLIP | METAL CLIP |
| | | | PCLIP | PLASTIC CLIP |
| | EJECT | EJECT | | EJECTOR |
| | EYELE | EYELE | | EYELET |
| | FRAME | FRAME | | FRAME |
| | FWSHR | FWSHR | | FLATWASHER |
| | LWSHR | LWSHR | | LOCKWASHER |
| | HANDL | HANDL | HANDL | HANDLE |
| | | | LOBAR | LOCKING BAR |
| | | | PUBAR | PULL BAR |
| | INSUL | INSUL | DISK | DISK INSULATOR |
| | | | PAD | PAD INSULATOR |
| | | | PLATE | PLATE INSULATOR |
| | | | WASHR | WASHER INSULATOR |
| | NUT | NUT | | NUT |
| | PIN | PIN | ALIGN | ALIGNMENT PIN |
| | | | SPRIN | SPRING PIN |
| | RRING | RRING | | RETAINING RING |
| | TIES | TIES | PTIES | PLASTIC TIES |
| | TIES | TIES | STIES | STRING TIES |
| | TRVT | TRVT | | TUBULAR RIVET |
| | SCREW | SCREW | | SCREW |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| | SHIEL | SHIEL | | SHIELD |
| | SLEEV | SLEEV | TUBE | SLEEVE TUBULAR |
| | | | HTSRK | HEAT SHRINK SLEEVING |
| | SPACE | SPACE | | SPACER |
| | SPREA | SPREA | | SPREADER |
| | SPRIN | SPRIN | COMPSP | COMPRESSION SPRING |
| | | | TENSP | TENSION SPRING |
| | | | THERMS | THERMAL PRESSURE SPRING |
| | VAR | IND | RDL | INDUCTOR |
| PWB | FLEX | FLEX | PWB | PRINTED WIRING BOARD |
| | HYB | HYB | PWB | PRINTED WIRING BOARD |
| | MOLD | MOLD | PWB | PRINTED WIRING BOARD |
| | RFLEX | RFLEX | PWB | PRINTED WIRING BOARD |
| | RIGID | RIGID | PWB | PRINTED WIRING BOARD |
| RES | FIXED | RES | | RESISTOR |
| | | RP_DH | | RESISTOR PACK DIP HYBRID |
| | | RP_DB | | RESISTOR PACK DIP BUSSED |
| | | RP_DI | | RESISTOR PACK DIP ISOLATED |
| | | RP_SB | | RESISTOR PACK SIP BUSSED |
| | | RP_SI | | RESISTOR PACK SIP ISOLATED |
| | | RP_ST | | RESISTOR PACK SIP TERMINATED |
| | | RP_SH | | RESISTOR PACK SIP HYBRID |
| | | RP_DT | | RESISTOR PACK DIP TERMINATED |
| | VAR | RHE | | RHEOSTAT |
| | | POT | | POTENTIOMETER |
| | | TMSTR | | THERMISTOR |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| ROTMA | ACMAC | ACMAC | | AC ROTATING MACHINERY |
| | DCMAC | DCMAC | | DC ROTATING MACHINERY |
| | SYNCH | SYNCH | | SYNCHRONOUS |
| SEMI | DIODE | BIZ | | BIZENER |
| | | BDIO | | BRIDGE DIODE |
| | | DIO | | DIODE |
| | | PSD | | PHOTO SENSITIVE DIODE |
| | | PED | | PHOTO EMISSIVE DIODE (LED) |
| | | TDI | | TUNNEL DIODE |
| | | TYSTR | | THYRISTOR DIODE |
| | | TYSTL | | LIGHT ACTIVATED THYRISTOR DIODE |
| | | TRANO | | TRANSORBE |
| | | ZDI | | ZENER DIODE |
| | SCR | SCR | | SILICON CONTROLLED RECTIFIER |
| | TRANS | DARP | | DARLINGTON P JUNCTION TRANSISTORS |
| | | DARN | | DARLINGTON N JUNCTION TRANSISTORS |
| | | FETP | | FIELD EFFECT P CHANNEL TRANSISTOR |
| | | FETN | | FIELD EFFECT N CHANNEL TRANSISTOR |
| | | OCPL | | OPTICAL COUPLER TRANSISTORS |
| | | TRNN | | NPN JUNCTION TRANSISTOR |
| | | TRNP | | PNP JUNCTION TRANSISTOR |
| | | UNIP | | UNIJUNCTION NP..N JUNCTION TRANSISTOR |
| | | UNIN | | UNIJUNCTION PN..P JUNCTION TRANSISTOR |
| SWTCH | RELAY | CKTB | | CIRCUIT BREAKER |
| | | RCL | | RELAY COIL |
| | | RCNO | | RELAY CONTACT NORMALLY OPEN |
| | | RCNC | | RELAY CONTACT NORMALLY CLOSED |
| | SWTCH | CSW | | CLOSED SWITCH |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| | | OSW | | OPEN SWITCH |
| TRADU | BELL | BELL | | BELL TRANSDUCER |
| | MIC | MIC | | MICROPHONE TRANSDUCER |
| | HALL | HALL | | HALL EFFECT TRANSDUCER |
| | SPK | SPK | | SPEAKER TRANSDUCER |
| | XTL | XTL | RDL | CRYSTAL |
| UCKT | DIG | LSI | CAN | LARGE SCALE INTEGRATION |
| | | | COB | CHIP ON BOARD |
| | | | DIP | DUAL INLINE PACKAGE |
| | | | FP | FLAT PACK |
| | | | GCC | GULL CHIP CARRIER |
| | | | JCC | J BEND CHIP CARRIER |
| | | | LCC | LEADLESS CHIP CARRIER |
| | | | PGA | PIN GRID ARRAY |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT |
| | | | TAB | TAPE AHESION |
| | | MSI | DIP | MEDIUM SCALE INTEGRATION |
| | | | COB | CHIP ON BOARD |
| | | | DIP | DUAL INLINE PACKAGE |
| | | | FP | FLAT PACK |
| | | | GCC | GULL CHIP CARRIER |
| | | | JCC | J BEND CHIP CARRIER |
| | | | LCC | LEADLESS CHIP CARRIER |
| | | | PGA | PIN GRID ARRAY |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT |
| | | | TAB | TAPE AUTOMATING BONDING |
| | | VLSI | DIP | VERY LARGE SCALE INTEGRATION |
| | | | COB | CHIP ON BOARD |
| | | | DIP | DUAL INLINE PACKAGE |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION | ------- |
|---|---|---|---|---|---|
| | | | FP | FLAT PACK | |
| | | | GCC | GULL CHIP CARRIER | |
| | | | JCC | J BEND CHIP CARRIER | |
| | | | LCC | LEADLESS CHIP CARRIER | |
| | | | PGA | PIN GRID ARRAY | |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT | |
| | | | TAB | TAPE AUTOMATING BONDING | |
| | | VHSIC | DIP | VERY HIGH SPEED INTEGRATED CIRCUIT | COB |
| | | | DIP | DUAL INLINE PACKAGE | |
| | | | FP | FLAT PACK | |
| | | | GCC | GULL CHIP CARRIER | |
| | | | JCC | J BEND CHIP CARRIER | |
| | | | LCC | LEADLESS CHIP CARRIER | |
| | | | PGA | PIN GRID ARRAY | |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT | |
| | | | TAB | TAPE AUTOMATING BONDING | |
| | | SSI | DIP | SMALL SCALE INTEGRATION | |
| | | | COB | CHIP ON BOARD | |
| | | | DIP | DUAL INLINE PACKAGE | |
| | | | FP | FLAT PACK | |
| | | | GCC | GULL CHIP CARRIER | |
| | | | JCC | J BEND CHIP CARRIER | |
| | | | LCC | LEADLESS CHIP CARRIER | |
| | | | PGA | PIN GRID ARRAY | |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT | |
| | | | TAB | TAPE AUTOMATING BONDING | |
| | HYB | CUST | DIP | CUSTOM INTEGRATED CIRCUIT | |
| | | | COB | CHIP ON BOARD | |

| CLASS | SUB | PTYPE | PKG | DESCRIPTION |
|---|---|---|---|---|
| | | | DIP | DUAL INLINE PACKAGE |
| | | | FP | FLAT PACK |
| | | | GCC | GULL CHIP CARRIER |
| | | | JCC | J BEND CHIP CARRIER |
| | | | LCC | LEADLESS CHIP CARRIER |
| | | | PGA | PIN GRID ARRAY |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT |
| | | | TAB | TAPE AUTOMATING BONDING |
| | LIN | ANA | DIP | ANALOG INTEGRATED CIRCUIT |
| | | | COB | CHIP ON BOARD |
| | | | DIP | DUAL INLINE PACKAGE |
| | | | FP | FLAT PACK |
| | | | GCC | GULL CHIP CARRIER |
| | | | JCC | J BEND CHIP CARRIER |
| | | | LCC | LEADLESS CHIP CARRIER |
| | | | PGA | PIN GRID ARRAY |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT |
| | | | TAB | TAPE AUTOMATING BONDING |
| | MIXED | ANA | DIP | ANALOG INTEGRATED CIRCUIT |
| | | | COB | CHIP ON BOARD |
| | | | DIP | DUAL INLINE PACKAGE |
| | | | FP | FLAT PACK |
| | | | GCC | GULL CHIP CARRIER |
| | | | JCC | J BEND CHIP CARRIER |
| | | | LCC | LEADLESS CHIP CARRIER |
| | | | PGA | PIN GRID ARRAY |
| | | | SOIC | SMALL OUTLINE INTEGRATED CIRCUIT |
| | | | TAB | TAPE AUTOMATING BONDING |
| XFMR | POWER | TRAP | RDL | TRANSFORMER |
| | SIGNL | TRAS | RDL | TRANSFORMER |

## APPENDIX IV

## 40.0 DATA LIST

### 40.1 DATA LIST

| DOCTYP | DOCNUM | DESCRIPTION |
|---|---|---|
| ASSEM | DRAWING NUMBER | ASSEMBLY DOCUMENT NUMBER |
| PWBSP | DRAWING NUMBER | PWB DOCUMENT NUMBER |
| PROG | DRAWING NUMBER | PROGRAM DOCUMENT NUMBER |
| PROSP | DRAWING NUMBER | PROCESS DOCUMENT |
| SCHEM | DRAWING NUMBER | SCHEMATIC DOCUMENT NUMBER |
| TSTSP | DRAWING NUMBER | TEST DOCUMENT NUMBER |
| CMPSP | DRAWING NUMBER | COMPONENT SPECIFICATION |
| NEXAS | DRAWING NUMBER | NEXT ASSEMBLY |
| USEON | DRAWING NUMBER | USED ON |

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# APPENDIX V

## 50.0 TRR COMPONDENT ATTRIBUTES

### 50.1 EDIF SCHEMATIC COMPONENT ATTRIBUTES

EDIF component attributes are those component attributes that are defined as properties of a schematic component symbol. The BNF description of these attributes is as follows:

```
comp-model: { comp-spec
              comp-class
              comp-prop
              comp-geom };

comp-class: { "CLASS" class-name };

class-name: { "CAP"
               cap-sub-name
               pkg-name |
              "CONN"
               conn-sub-name
               pkg-name |
              "IND"
               ind-sub-name
               pkg-name |
              "OTHER"
               other-sub-name
               pkg-name |
              "PWB"
               pwb-sub-name
               pkg-name |
              "RES"
               res-sub-name
               pkg-name |
```

```
                    "SEMI"
                     semi-sub-name
                     pkg-name |
                    "SWTCH"
                     swtch-sub-name
                     pkg-name |
                    "UCKT"
                     uckt-sub-name
                     pkg-name |
                    "XFMR"
                    xfmr-sub-name };
                    pkg-name ;
                     "XTL"
                     xtl-sub-name
                     pkg-name |

cap-sub-name: { "FIXED" | "VAR" };

res-sub-name: { "FIXED" | "VAR" };

conn-sub-name: { "PLUG" | "RECPT" | "EDGE" | "TERM" |
                         "TP" | "KEY" | "ADAPT" };

ind-sub-name: { "FIXED" | "VAR" };

other-pkg-name: { "SCREW" | "BOLT" | "NUT" | "RIVET" |
                  "FWSHR" | "LWSHR" | "BAGT" | "CAGT" | "MAGT" };

pwb-sub-name: { "FLEX" | "HYB" | "MOLD" | "RFLEX" |
                "RIGID" };

semi-sub-name: { "LED" | "DIODE" | "TRANS" | "VRSTR" |
                 "TMSTR" | "TYSTR" | "OCPL" };
```

```
swtch-sub-name: { "SWTCH" | "RELAY" };

uckt-sub-name: { "LIN" | "DIG" };

xfmr-sub-name: { "POWER" | "SIGNAL" };

pwb-pkg-name:  { "TYPE1" | "TYPE2" | "TYPE3" | "TYPE4" | "TYPE5" | "TYPE6" };

pkg-name:      { "AXIAL" | "CAN" | "CHIP" | "RDL" | "SM" | "SM" | "PLCLP" |
               "MTCLP" | "PCLIP" | "HANDL" | "LOBAR" | "PUBAR" | "DISK" |
               "PAD" | "PLATE" | "WASHR" | "ALIGN" | "SPRIN" | "PTIES" |
               "STIES" | "TUBE" | "HTSRK" | "COMPS" | "TENSP" | "THERS" };

attribute_name: "PTYPE" ptype-name
                 "RDES" rdes-name
                ["CHTYP_VAL" chtyp_val-name]
                ["CHTYP_PTL" chtyp_ptl-name]
                ["CHTYP_NTL" chtyp_ntl-name]
                "GPN" gpn-name
                ["CHTYP_LT" chtyp_lt-name]
                "AP_SPEC" ap_spec-name
                "PN" pn-name
                "ITEM" item-name
                ["CAGE" cage-name]
                ["MAX_WK_VOLT" max_wk_volt-name]
                ["COMP_PWR" comp_pwr-name]
                ["SOLDERABILITY" solderability-name]
                ["LEAD_MAT" lead_mat-name]
                ["LEAD_PLT" lead_plt-name]
                ["REV" rev-name]
```

## 50.2 IGES 3D COMPONENT ATTRIBUTES IN IGES HEADER

IGES 3D component attributes are those component attributes that are defined as properties of a 3D component.

"SPEC" spec-name
["SNUM" snum-name]
["DNUM" dnum-name]
["STYLE" style-name]
["CASE" case-name]
["AP_SPEC" ap_spec-name]
["EIA_JEDEC" eia_jedec-name]
"CLASS" class-name
"SUB" sub-name
"PKG" pkg-name
["Qnty" qnty-name]
["MAX_WK_VOLT" max_wk_volt-name]
["COMP_PWR" comp_pwr-name]
["SOLDERABILITY" solderability-name]
["LEAD_MAT" lead_mat-name]
["LEAD_PLT" lead_plt-name]
"MAX_BODY_DIA" max_body_dia-number
"NOM_BODY_DIA" nom_body_dia-number
"MIN_BODY_DIA" min_body_dia-number
"MAX_BODY_LEN" max_body_len-number
"NOM_BODY_LEN" nom_body_len-number
"MIN_BODY_LEN" min_body_len-number
"MAX_BODY_WDT" max_body_wdt-number
"NOM_BODY_WDT" nom_body_wdt-number
"MIN_BODY_WDT" min_body_wdt-number
"MAX_BODY_HGT" max_body_hgt-number
"NOM_BODY_HGT" nom_body_hgt-number
"MIN_BODY_HGT" min_body_hgt-number
"MAX_LEAD_DIA" max_lead_dia-number

"NOM_LEAD_DIA" nom_lead_dia-number
"MIN_LEAD_DIA" min_lead_dia-number
"MAX_LEAD_LEN" max_lead_len-number
"NOM_LEAD_LEN" nom_lead_len-number
"MIN_LEAD_LEN" min_lead_len-number
"MAX_LEAD_WDT" max_lead_wdt-number
"NOM_LEAD_WDT" nom_lead_wdt-number
"MIN_LEAD_WDT" min_lead_wdt-number
"MAX_LEAD_THK" max_lead_thk-number
"NOM_LEAD_THK" nom_lead_thk-number
"MIN_LEAD_THK" min_lead_thk-number

## 50.3 COMPONENT ATTRIBUTE DATA FORMAT

ptype-name: { "ANA" "BIZ" | "CAP" | "CSW"| "CUST" |"ZDI"|
"DAR" | "DIO" | "DIPCAP" | "EDG" | "FET" | "FUS"| "HYB" |
"IND" | "JUM" | "LED" | "LSI" | "MSI" | "OPJ" | "OSW" |
"PCA" | "PWB" | "PIS" | "POT" |
"PWB" | "RCL" | "RCNO" | "RCNC" | "RES" | "RHE" |
"RP_DB" | "RP_DH" | "RP_DI" | "RP_DT" | "RP_SB"|
"RP_SH" | "RP_SI" | "RP_ST" | "SCR" | "SSI" |
"TCA" | "TPCP" | "TPCS" | "TRA" | "TRNN" |
"TRNP" | "UNI" | "VHSIC" | "VLSI" | "XTL" | "ZDI");

rdes-name: { any alpha-numeric ASCII character not to exceed 8 characters in length);

f4-number: { "1" | "1" | "1" | "1" |
"2" | "2" | "2" | "2" |
"3" | "3" | "3" | "3" |
"4" | "4" | "4" | "4" |
"5" | "5" | "5" | "5" |
"6" | "6" | "6" | "6" |
"7" | "7" | "7" | "7" |

```
            "8" | "8" | "8" | "8" |
            "9" | "9" | "9" | "9" |
            "0" | "0" | "0" | "0" | };

pos-integer: { "1" | "2" | "3" | ...};

val-multiplier: { "T" | "G" | "M" | "K" | "m" | "u" | "n" | "p" | "f"};

chtyp_ntl-name: percent;

chtyp_ptl-name: percent;

percent: { "1" | "1" | "1" | "." | "1" |
           "2" | "2" | "2" | "." | "2" |
           "3" | "3" | "3" | "." | "3" |
           "4" | "4" | "4" | "." | "4" |
           "5" | "5" | "5" | "." | "5" |
           "6" | "6" | "6" | "." | "6" |
           "7" | "7" | "7" | "." | "7" |
           "8" | "8" | "8" | "." | "8" |
           "9" | "9" | "9" | "." | "9" |
           "0" | "0" | "0" | "." | "0" | };

gpn-name: { any alpha numeric ASCII name not to exceed 15
          characters in length};

chtyp_lt-name: { "ALU" | "ANA" | "CLK" | "CNT" | "COM" |
                "DMUX" | "DRAM" | "HYB" | "MUX" | "PIO" |
                "PLD" | "RAM" | "ROM" | "SEQ" | "SRAM" |};

ap_spec-name: { any alpha-numeric ASCII name not to exceed 15
               characters in length};

pn-name: { any alpha-numeric ASCII name not to exceed 18 characters in
         length};
```

```
qnty-name: {   f3-number | "NS" | "AR" | IN | FT | OZ | LB | EA
                         | CM | KM | MM | L | ML | PT | QT | GAL };

item-name: { f4-number };

cage-name: { f5-number };

f5-number: { "1" | "1" | "1" | "1" | "1" |
             "2" | "2" | "2" | "2" | "2" |
             "3" | "3" | "3" | "3" | "3" |
             "4" | "4" | "4" | "4" | "4" |
             "5" | "5" | "5" | "5" | "5" |
             "6" | "6" | "6" | "6" | "6" |
             "7" | "7" | "7" | "7" | "7" |
             "8" | "8" | "8" | "8" | "8" |
             "9" | "9" | "9" | "9" | "9" |
             "0" | "0" | "0" | "0" | "0" | };

f15-number:
{ "1" | "1" | "1" | "1" | "1" | "1" | "1" | "1" |
  "2" | "2" | "2" | "2" | "2" | "2" | "2" | "2" |
  "3" | "3" | "3" | "3" | "3" | "3" | "3" | "3" |
  "4" | "4" | "4" | "4" | "4" | "4" | "4" | "4" |
  "5" | "5" | "5" | "5" | "5" | "5" | "5" | "5" |
  "6" | "6" | "6" | "6" | "6" | "6" | "6" | "6" |
  "7" | "7" | "7" | "7" | "7" | "7" | "7" | "7" |
  "8" | "8" | "8" | "8" | "8" | "8" | "8" | "8" |
  "9" | "9" | "9" | "9" | "9" | "9" | "9" | "9" |
  "0" | "0" | "0" | "0" | "0" | "0" | "0" | "0" |..5};

max_wk_volt-name : { f7.4-number };
```

```
f7-number:
{ "1" | "1" | "1" | "1" | "1" | "1" | "1" | "1" |
  "2" | "2" | "2" | "2" | "2" | "2" | "2" | "2" |
  "3" | "3" | "3" | "3" | "3" | "3" | "3" | "3" |
  "4" | "4" | "4" | "4" | "4" | "4" | "4" | "4" |
  "5" | "5" | "5" | "5" | "5" | "5" | "5" | "5" |
  "6" | "6" | "6" | "6" | "6" | "6" | "6" | "6" |
  "7" | "7" | "7" | "7" | "7" | "7" | "7" | "7" |
  "8" | "8" | "8" | "8" | "8" | "8" | "8" | "8" |
  "9" | "9" | "9" | "9" | "9" | "9" | "9" | "9" |
  "0" | "0" | "0" | "0" | "0" | "0" | "0" | "0" |..15);

comp_pwr-name: { f7-number };

solderability-name : { "NIL" | "NOWAV" | "NRFLO" };

lead_mtl-name: { "STL" | "OTH" };

lead_plt-name: { "GLD" | "OTH" };

rev-name: { DOD-STD-100 change letters length};
spec-name: { any alpha numeric ASCII name not to exceed 15  characters
          in length};

snum-name: { any alpha numeric ASCII name not to exceed 4   characters
          in length};

dnum-name: { any alpha numeric ASCII name not to exceed 4   characters
          in length};

style-name: { any alpha numeric ASCII name not to exceed 8  characters
          in length};
```

```
case-name: { any alpha numeric ASCII name not to exceed 8
              characters in length};

eia_jedec-name: { any alpha numeric ASCII name not to exceed 4
                   characters in length};

nom_body_dia-number: { f7.4-number };

min_body_dia-number: { f7.4-number };

max_body_len-number: { f7.4-number };

nom_body_len-number: { f7.4-number };

min_body_len-number: { f7.4-number };

max_body_wdt-number: { f7.4-number };

nom_body_wdt-number: { f7.4-number };

min_body_wdt-number: { f7.4-number };

max_body_hgt-number: { f7.4-number };

nom_body_hgt-number: { f7.4-number };

min_body_hgt-number: { f7.4-number };

max_lead_dia-number: { f7.4-number };

nom_lead_dia-number: { f7.4-number };

min_lead_dia-number: { f7.4-number };
```

```
max_lead_len-number: { f7.4-number };

nom_lead_len-number: { f7.4-number };

min_lead_len-number: { f7.4-number };

max_lead_wdt-number: { f7.4-number };

nom_lead_wdt-number: { f7.4-number };

min_lead_wdt-number: { f7.4-number };

max_lead_thk-number: { f7.4-number };

nom_lead_thk-number: { f7.4-number };

min_lead_thk-number: { f7.4-number };

f7.4-number: { "1" | "1" | "1" | "." | "1" | "1" | "1" | "1" |
               "2" | "2" | "2" | "." | "2" | "2" | "2" | "2" |
               "3" | "3" | "3" | "." | "3" | "3" | "3" | "3" |
               "4" | "4" | "4" | "." | "4" | "4" | "4" | "4" |
               "5" | "5" | "5" | "." | "5" | "5" | "5" | "5" |
               "6" | "6" | "6" | "." | "6" | "6" | "6" | "6" |
               "7" | "7" | "7" | "." | "7" | "7" | "7" | "7" |
               "8" | "8" | "8" | "." | "8" | "8" | "8" | "8" |
               "9" | "9" | "9" | "." | "9" | "9" | "9" | "9" |
               "0" | "0" | "0" | "." | "0" | "0" | "0" | "0" | };
               name" | "any alpha numeric ASCII name" };
```

END FORMAL SYNTAX

# APPENDIX VI
## 60.0 TRR IGES LAYERING CONVENTION

| TABLE FOR TRR IGES LAYERING CONVENTION |
|---|
| Assembly Layers: |
| LAYER 00 |
| LAYER 05 CAP |
| LAYER 10 GLUE |
| LAYER 15 |
| LAYER 20 |
| LAYER 25 OTHER |
| LAYER 30 IND |
| LAYER 35 |
| LAYER 40 RES |
| LAYER 45 |
| LAYER 50 SEMI |
| LAYER 55 SWTCH |
| LAYER 60 XTL |
| LAYER 65 UCKT |
| LAYER 70 XFMR |
| LAYER 75 |
| LAYER 79 |
| LAYER 80 SPECIAL ASSEMBLY CAP |
| LAYER 84 SPECIAL ASSEMBLY CAP INTRUCTIONS |
| LAYER 85 |
| LAYER 89 |
| LAYER 90 SPECIAL ASSEMBLY CONN |
| LAYER 94 SPECIAL ASSEMBLY CONN INSTRUCTIONS |
| LAYER 95 |
| LAYER 99 |
| LAYER 100 SPECIAL ASSEMBLY OTHER |
| LAYER 104 SPECIAL ASSEMBLY OTHER INSTRUCTIONS |
| LAYER 105 SPECIAL ASSEMBLY IND |
| LAYER 109 SPECIAL ASSEMBLY IND INSTRUCTIONS |
| LAYER 110 |
| LAYER 114 |
| LAYER 115 SPECIAL ASSEMBLY RES |
| LAYER 119 SPECIAL ASSEMBLY RES INSTRUCTIONS |
| LAYER 120 SPECIAL ASSEMBLY ROTMA |
| LAYER 124 SPECIAL ASSEMBLY ROTMA INSTRUCTIONS |
| LAYER 125 SPECIAL ASSEMBLY SEMI |
| LAYER 129 SPECIAL ASSEMBLY SEMI INSTRUCTIONS |
| LAYER 130 SPECIAL ASSEMBLY SWTCH |
| LAYER 134 SPECIAL ASSEMBLY SWTCH INSTRUCTIONS |
| LAYER 135 SPECIAL ASSEMBLY XLT |

# APPENDIX VII
## 70.0 TRR RPTS TO RAMP PWA FACTORY MAPPING

| RPTS | | RAMP PWA FACTORY | | |
|---|---|---|---|---|
| CLASS | SUB | CLASS | SUB | PKG |
| BATTE | NONR | OTHER | HDWR | OTHER |
| BATTE | RECH | OTHER | HDWR | OTHER |
| CAP | FIXED | CAP | FIXED | |
| CAP | VAR | CAP | VAR | |
| CHEM | BAGT | OTHER | BAGT | OTHER |
| CHEM | CAGT | OTHER | CAGT | OTHER |
| CHEM | CLAGT | OTHER | OTHER | OTHER |
| CHEM | IAGT | OTHER | IAGT | OTHER |
| CHEM | MAGT | OTHER | MAGT | OTHER |
| CHEM | TAGT | OTHER | TAGT | OTHER |
| CON | ANTENNA | OTHER | OTHER | OTHER |
| CON | BUSBAR | CONN | OTHER | OTHER |
| CON | EDGE | CONN | EDGE | OTHER |
| CON | FUSE | OTHER | OTHER | |
| CON | JUM | CONN | OTHER | |
| CON | PLUG | CONN | PLUG | |
| CON | RECEPT | CONN | RECEPT | |
| CON | TERM | CONN | TERM | |
| CON | TERMST | OTHER | OTHER | OTHER |
| CON | TERMSP | OTHER | OTHER | OTHER |
| CON | TESTBK | OTHER | OTHER | OTHER |
| CORE | FEBED | OTHER | OTHER | OTHER |
| IND | FIXED | IND | FIXED | |
| IND | VAR | IND | VAR | |
| LAMP | FLOUR | OTHER | OTHER | OTHER |
| LAMP | GLOW | OTHER | OTHER | OTHER |
| LAMP | INCAN | OTHER | OTHER | OTHER |
| LAMP | BALLA | OTHER | OTHER | OTHER |
| HDWR | BOLT | OTHER | HDWR | BOLT |
| HDWR | BRACK | OTHER | HDWR | BRACK |
| HDWR | BRVT | OTHER | HDWR | BRVT |
| HDWR | CRVT | OTHER | HDWR | CRVT |
| HDWR | CLIP | OTHER | HDWR | CLIP |
| HDWR | EJECT | OTHER | HDWR | EJECT |
| HDWR | EYELE | OTHER | HDWR | EYELE |
| HDWR | FRAME | OTHER | HDWR | FRAME |

TABLE FOR TRR (CONT'D)
IGES LAYERING CONVENTION

LAYER 139 SPECIAL ASSEMBLY XTL INSTRUCTIONS
LAYER 140 SPECIAL ASSEMBLY UCKT
LAYER 144 SPECIAL ASSEMBLY UCKT INSTRUCTIONS
LAYER 145 SPECIAL ASSEMBLY XMFR
LAYER 149 SPECIAL ASSEMBLY XMFR INSTRUCTIONS
LAYER 150 SPECIAL GENERAL INSTRUCTIONS
LAYER 155 MAXIMUM ASSEMBLY ENVELOPE
LAYER 160 CONFORMAL COAT MASK
LAYER 165 ASSEMBLY INKING OR MARKING
LAYER 170 ASSEMBLY DATA LIST
LAYER 180 PWB

| RPTS | | RAMP PWA FACTORY | | |
|---|---|---|---|---|
| CLASS | SUB | CLASS | SUB | PKG |
| HDWR | FWSHR | OTHER | OTHER | FWSHR |
| HDWR | LWSHR | OTHER | HDWR | LWSHR |
| HDWR | HANDL | OTHER | HDWR | HANDL |
| HDWR | NUT | OTHER | HDWR | NUT |
| HDWR | PIN | OTHER | HDWR | PIN |
| HDWR | TRVT | OTHER | HDWR | TRVT |
| HDWR | SCREW | OTHER | HDWR | SCREW |
| HDWR | SHIEL | OTHER | HDWR | SHIEL |
| HDWR | SPRIN | OTHER | HDWR | SPRIN |
| PWB | FLEX | PWB | FLEX | |
| PWB | HYB | PWB | HYB | |
| PWB | MOLD | PWB | MOLD | |
| PWB | RFLEX | PWB | RFLEX | |
| PWB | RIGID | PWB | RIGID | |
| RES | FIXED | RES | FIXED | |
| RES | VAR | RES | VAR | |
| ROTMA | ACMAC | OTHER | OTHER | OTHER |
| ROTMA | DCMAC | OTHER | OTHER | OTHER |
| ROTMA | SYNCH | OTHER | OTHER | OTHER |
| SEMI | DIODE | SEMI | DIODE | |
| SEMI | SCR | SEMI | DIODE | |
| SEMI | TRANS | SEMI | TRANS | |
| SWTCH | RELAY | SWTCH | RELAY | |
| SWTCH | SWTCH | SWTCH | SWTCH | |
| TRADUC | BELL | OTHER | OTHER | OTHER |
| TRADUC | MIC | OTHER | OTHER | OTHER |
| TRADUC | HALL | OTHER | OTHER | OTHER |
| TRADUC | SPK | OTHER | OTHER | OTHER |
| TRADUC | XTL | XTAL | XTAL | |
| UCKT | DIG | UCKT | DIG | |
| UCKT | HYB | UCKT | HYB | |
| UCKT | HYB (PTYPE)OSC | XTAL | OSC | |
| UCKT | LIN | UCKT | LIN | |
| UCKT | MIXED | UCKT | MIXED | |
| XFMR | POWER | XFMR | POWER | |
| XFMR | SIGNL | XFMR | SIGNL | |

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